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Agricultural Gazette of New South Wales.

Irrigation.

W. J. ALLEN.

To Australia this word means more than the majority of the present generation may imagine, as, owing to the erratic nature of the seasons in our dryer interior districts, one cannot depend upon any two seasons being at all alike. Some years we have good early rains in the fall, which provide plenty of good green feed for all the stock, as well as moistening the ground so that

Land suitable for fruit-growing under irrigation on the Murray. Before clearing.

ploughing for wheat may be proceeded with; and during such years there are enormous increases in stock and big clips of wool, and every-one is happy. The next year the rainfall may be nearly as great as during the preceding, and perhaps the yield of wheat may be about the same, but in place of the rain falling early there may not be sufficient to start the feed growing until well into the winter, with the result that, owing to the lack of green feed, most of the lambs die, or are, perhaps, killed to save the ewes. The

wool is not so good, nor is the clip so heavy or valuable as during the previous more favourable season. While we can never hope to help all those interested in stock and wheat growing, it will be possible to help hundreds of those who are already on the soil, as well as putting thousands more on smaller holdings, varying from 10 to 100 acres, on areas of which size, with the aid of water, they will be able to make very comfortable livings, provided always that we can conserve a little of the rain which falls, and put it on the land at a reasonable cost. Owing to the very flat nature of most of our country there are very few places where this can be done by gravitation;

Mallee Land suitable for lucerne-growing in the Balranald District. Before clearing.

there are, however, many places where, by the use of the most up-to-date pumps, water can be lifted from our rivers at a fairly reasonable cost. Of course, wherever pumping has to be undertaken, the expense of fuel is an item for consideration; so that wherever it is possible to formulate a scheme of irrigation where the water can be made to gravitate from its source, even though the initial cost may be ever so much greater, it will in the end be by far the most economical.

Unfortunately for Australia, until such time as her rivers are locked there are few places where the starting of such a scheme as this latter would be practicable, while, on the other hand, there are hundreds of places where

water could be lifted and made to cover land, which would at least help to save millions of stock during our bad seasons; and even were the rivers

Bend of the Murray River at Red Cliffs (120 feet high).

locked, the majority of landowners along their banks would in all probability still have to pump the water required for irrigation purposes; but, even with the extra cost which pumping means compared with gravitation, what better means of insurance could we have?

Scene on the Darling.

It was shown only a few years ago that 1 acre of lucerne under irrigation would keep seventy-five sheep in fairst ore condition; what, then, would it

have meant during the drought if in different parts of our State we had had, say, 2,000 stock-owners, each holding anywhere from 3 to 600 acres of lucerne under cultivation during such a year?

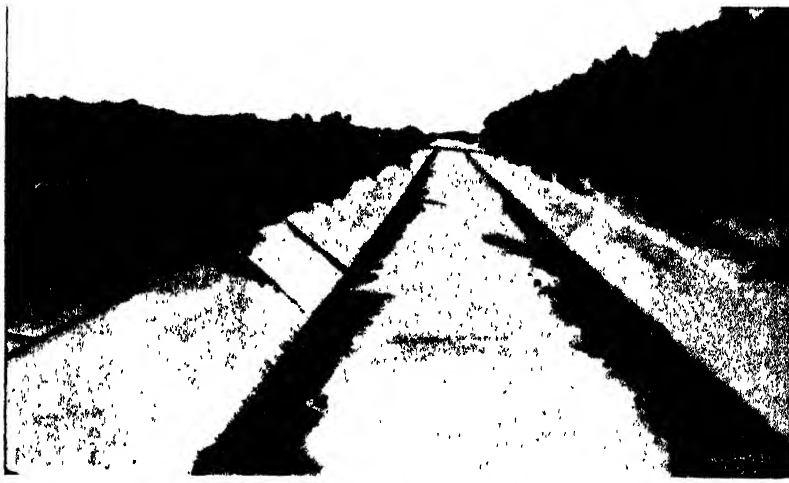
If there were a few locks in the Darling, Murrumbidgee, Macquarie, and Edwards rivers, and the landowners were to take up this important question in earnest, it would be quite possible for Australia, without any risk, to carry double the quantity of stock she has ever carried, and to grow about twice the wheat she is now growing. Such a state of things cannot be

Pumping Plant in use on Moorara Station, on the Darling.

brought about all at once, as the people have to be educated up to the manner of using the water before they will understand its many advantages.

There seems to be in the minds of a great number of Australians a strong prejudice against starting any large scheme of irrigation. While such is the case it will be wise to hasten slowly until the benefits to be derived are more thoroughly understood. It is not at all unlikely that should the Government start a good scheme, that it will be some years before the public will appreciate their efforts, and they need not feel discouraged if they find themselves the subject of much adverse criticism; but let them start on good sound business lines, by securing a good supply of water and delivering

it in good channels (which are lined where necessary so as to avoid seepage), then establish a good experimental station, where the work is carried out in the most up-to-date practical manner, for the benefit of those who are



Main Channel at Mildura, 18 feet wide at bottom.
(Lined with concrete.)

interested in this work, and it will not be long before the public will begin to realise that the State acted wisely when it began a system of water conservation and irrigation.

Subsidiary Channel about 18 inches at bottom.
(Lined with concrete.)

To bring such a scheme to a successful issue, good scientific and highly practical men with plenty of push and energy are required to carry it along until it is once thoroughly established.

In looking over the work that has been done up to the present in the State, one has to admit that we have not yet made a start. In two or three places a few hundred acres have been cut up and arrangements made to provide would-be settlers with water, but from lack of knowledge rather than every good intention such schemes were started on soil which was quite unfit for the purpose, with the result that to-day we are no further ahead than we were ten years ago. The little which has been done, however, has taught us which are the most suitable lands to place under irrigation, also which land to avoid. This in itself is a valuable lesson, and one which, I presume, has not been too dearly paid for.

Wherever irrigation has been carried out on good loamy soil which has had a fair natural drainage, good results have been obtained ; and it is on

Mr. Shepherd's Orchard on the Nepean. Irrigating Orange Trees through furrows.

such lands, whether they be alluvial, such as are found in many of our river flats or the light medium loamy soil with or without limestone nodules in the subsoil, that we will find some of our best land for growing crops under irrigation.

The Works Department have at present under consideration a large scheme which should commend itself to the public, as the water is to be delivered by gravitation on to some of the best land we have for irrigation purposes. There are several different classes of land, some of which is suitable for growing the very best fruits for either drying or the fresh fruit trade, while some is first-class lucerne land which will produce six cuts of hay per annum. Other portions are suitable for the growth of sorghum, wheat, vegetables, cotton, tobacco, &c., &c. Dairying and raising lambs for

export and pigs for bacon will also be profitable industries to take up. In our warm climates with a sufficient supply of water intelligently applied to our best lands there should be no such thing as failure, and there is no pleasanter life, nor is there any more healthy calling. In such a place it is possible to grow nearly everything that is required—the wool, meat, wheat, vegetables, fresh and dried fruits, poultry, tobacco, &c., &c.

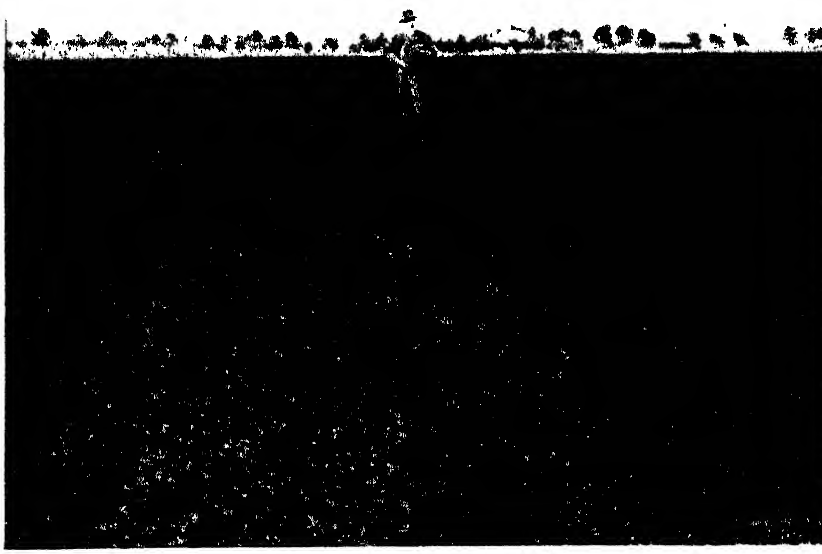
Apart from the question of land suitable for irrigation and a supply of good pure water free from any injurious ingredients, is the question of the application of same to the different crops, and of which there are two methods usually followed, that is flooding and furrows.

Orange Trees growing under Irrigation on the Darling (Moorara Station).

Sub-irrigation is practised on a limited scale in some few places, but is rather an expensive undertaking. The furrow system is that most generally used wherever it is practicable, as it has the merit of being most economical; there is the minimum loss of water through evaporation; and it can be so handled that the land receives an even soaking. There is very little, if any, waste water, and the furrows can be cultivated in as soon as they are dry enough, and land well cultivated after being irrigated retains the moisture, the loose soil on the top acting as a mulch and preventing its escape. It will, therefore, be seen that crops so watered and worked will require less frequent waterings than where cultivation is not carried out.

In irrigating through furrows care should be taken to see that just sufficient water is turned into a furrow to keep it wet from top to bottom, as by so doing the land receives a thorough soaking without damage by scouring, as is the case when an unnecessary large quantity of water is allowed to run.

In America, it is not an unusual sight to see fluming in place of earthen head-channels, and the water is turned into the furrows by opening a small slide made of thin galvanised iron, which can be so regulated as to permit just the desired quantity of water to run into any one furrow, and one man can attend to several hundred furrows with but little trouble, if the land is properly levelled and the head-channels or flumes are properly constructed.



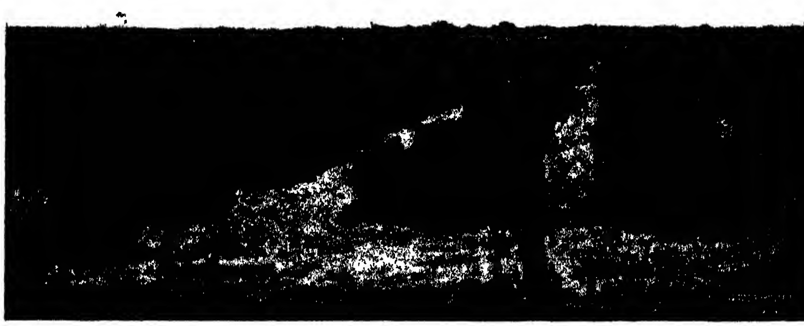
Lucerne growing under irrigation—a fortnight after being cut.

All land required for irrigation should, therefore, be levelled, and suitable head-channels made, before any attempt is made to run water, as much trouble and labour in after years can be avoided by attending to this work. In ordinary earth-channels, it is well to have drops at convenient distances, so that by closing one, or putting in an extra slide in same, it will raise the water sufficiently high to divert it into the different furrows. Holes may be cut into the side of the head-drain, to allow the water to run into the furrows, and straw, weeds, or hessian may be used for equalising the flow of water, as it will be found that some furrows will have more water than others. Of course, this is more of a makeshift, and sluice-boxes will be found much better. These should be let into the banks of the channel, and through them the water is run into the furrows, and the quantity of water regulated by a slide As there are generally a few weeds or a little moss in the water, it is

necessary to inspect the slide from time to time, in order to keep them free from any such rubbish, and ensure a regular flow.

A constant watch should be kept on all furrows, to see that the water does not break from same and spread over the land to its detriment.

Another important point, which in this country is very often neglected, is a waste-water drain, so situated that it will catch any surplus water, and deliver it on to some other section of the farm where it can be made use of. It also acts as a surface drain, so that as soon as the soil is thoroughly soaked, all surplus water may be turned into the drain, and not allowed to stand on the soil or crops, as is so often the case. Such stagnant water is very frequently the cause of trees, crops, or vines dying out in a most mysterious manner. In fact, I consider many of the reported failures at the different



Mr. J. Boyd's Vineyard on Wentworth Irrigation Area.

artesian bores are traceable to this, the use of too much water, and lack of cultivation and surface drainage rather than to any other of the many causes brought forward at times by those who claim that artesian water is not suitable for irrigation.

Lucerne is usually flooded by turning large heads of water into the block along the highest side, until it is thoroughly soaked, when any standing water is drawn off, to avoid damage to the plants. Blocks may be of any size from ½ to 10 acres. Around each block there is a bank thrown up to a sufficient height to keep the water within the block. The sides of the bank to have a gradual slope, so that machines, wagons, and carts may be driven over easily during harvesting operations.

Before sowing lucerne seed the land should be watered if it is dry, then ploughed to a good depth, and if it has been well worked up and levelled before the last irrigation, it should be harrowed, and rolled with a light roller, and then the seed sown in drills 9 inches apart, using from 10 to 12 lb. of the best seed obtainable, to the acre. If the work is properly done the seed

will come up well and will not require a further watering until it is several inches high. A good time for sowing is in the early fall some time early in March, or if sown in the spring, September or October are good months. After the seed is well up, a light harrowing would be found beneficial. As soon as the lucerne is from 10 to 12 inches high, it is well to cut it and allow the hay to remain on the ground as a protection to the young plants. Cutting has the effect of making lucerne stool out and thicken up so as to cover the ground. The lucerne should be given a thorough watering just before cutting

A 7-year old Orange Tree growing at Pera Bore, and watered with artesian water.

so that it will make a strong growth afterwards. Best results are obtained if the crop receives a thorough soaking every month through the six hottest months.

Planting Trees and Vines.

The land should be properly levelled preparatory to planting. If it is damp the trees may be planted without running the water down a furrow between the double stakes; but should the planting be done when the ground is dry, it is best to soak the latter before planting. Again, as soon as the trees are planted, the sooner the water reaches the newly-planted tree the better are its chances for making a strong start. As soon as the ground is dry, all young trees and vines should be well worked around with a fork hoe and the

soil between the rows worked to a fine tilth. Should the weather continue hot and dry, a second irrigation should be given within three weeks from date of planting—if they are citrus trees. Deciduous trees or vines would not require water so quickly, but if the young plants do not start readily watering must not be neglected, as there is nothing like plenty of water for newly-planted trees. After once the trees and vines are well established less water may be used but plenty of cultivation, the latter being of as much if not of more importance than the former.

A Date Palm growing at Pera Bore, and watered with artesian water.

After the first year or two deciduous trees should not require more than two or three irrigations during the summer, but they require plenty of cultivation from the early spring throughout the summer.

Citrus orchards usually require more irrigations than deciduous, but the trees should not be kept growing too late into the fall else the growth will be tender, and should frosts start early the trees and fruit are liable to be badly frozen. It will also be found that citrus fruit taken from trees irrigated late will not keep as well as fruit from trees which have not been over irrigated or watered late.

If vines are well watered in the winter they will not require so many summer waterings, but the ground must be cultivated deep and often. Avoid irrigating when grapes are flowering and setting.

Potatoes.

Work the land up well, and if it be dry, irrigate just before ploughing. Plough deeply as soon as the land is dry, and plant immediately. Keep the ground well harrowed until the young plants are well up. One good irrigation, or at the most two, are all that is required for spring crops, and these should be given before the young potatoes are any size, as later watering will induce a second growth, which spoils the tubers.

The secret in potato growing is good cultivation, combined with as little water as is necessary to keep the plants in good growing condition.

The spring crop should be planted as soon as the severe frosts are over, which is usually towards the end of August and the fall crop in February. They should be planted in drills 3 feet apart, and when it is found necessary to irrigate, furrows may be drawn midway between the rows and water allowed to run until the ground is well soaked. As before stated, two waterings with good cultivation should be sufficient for any spring crop of potatoes. The fall crop will naturally require one or two more waterings than the spring crop, as the ground is dryer at that time of the year and the heat more intense.

Peas.

These may be sown in drills in moist soil. If sown during hot weather they will require more frequent irrigations and cultivation than during the cooler months. They should be irrigated by drawing a furrow between each row of peas and running the water down same. Drills should be about the same distance apart as for potatoes.

Corn (Maize).

The drills should be 4 feet apart. If the ground is dry, furrows should be drawn and water run along previous to planting; the seed is then dropped into these drills, and covered by a light furrow, after which the ground should receive a thorough cultivation. Future watering should be made through furrows drawn between the rows. This crop is usually raised as green feed for milking cows, or for ensilage, as under irrigation very heavy crops can be produced.

Grain.

Unless the ground is moist, it is best to thoroughly saturate it with water, and as soon as it is dry enough it should receive a good deep ploughing and harrowing, and the seed should be drilled in from day to day, as the ploughing, &c., proceeds, when the grain will soon make its appearance above ground. By working the ground as above it holds the moisture much better than it would if the land were ploughed while dry, and the seed sown and watered to cause germination, which latter process tends to set the soil which would require a second irrigation long before that which had received the watering before ploughing.

At time of harvesting, it will be found that the heaviest yield will come from that portion which had been watered before being sown, and the writer's experience has been that the one crop was much heavier than the other.

When seed is sown in moist soil the latter usually requires no irrigation for two or three months, during which time the grain will make a good growth and send its roots down deeper than into a soil which had received an irrigation directly it was sown. By the time the moisture stored in the ground before sowing has evaporated, the grain will have made a good growth, therefore, when water is applied evaporation from the soil is not so great as it would be from crops irrigated at an earlier stage. Hence the soil of such fields remains in much better condition than that in those irrigated directly after seeding, and the grain has an opportunity of making a correspondingly better growth, and in consequence gives a greater yield. Immediately after sowing, furrows should be drawn at distances of from 3 to 4 feet apart for future waterings.

Sorghum.

The seed is sown on deeply worked moist soil and furrows made at distances of from 3 to 4 feet apart through which to run the water for future irrigations. Good crops of this fodder-plant can be grown on fairly heavy soil.

Many other crops, such as pumpkins, cabbages, cauliflowers, squashes, onions, watermelons, tomatoes, strawberries, and all other garden vegetables, can be grown with very little trouble.

Where trees, vines, or other fruits and vegetables are grown under irrigation, care should be taken to see that water does not flow over the surface of the soil about the trees or plants, and after each irrigation the cultivator is brought into requisition, and the fork hoe, for loosening up the soil close to either trees or plants.

The illustrations used in this article are from photographs taken at various times in different parts of the State, from the dry interior of the Darling to the banks of the Nepean in the coastal district.

Notes on Fowl-Tick and Poultry.

WALTER W. FROGGATT, F.L.S.,
Government Entomologist.

It is some years since the fowl-tick was discovered and reported as a well-established pest in New South Wales (*Agricultural Gazette*, 1896). Since then it has extended its range all over the south-western towns, and is also common in all the Victorian towns along the Murray Valley as far as Benalla. Broadly speaking, the district infested in the State includes the whole of Riverina, up north and west as far as Bourke, and coming towards the east reaches as far as Wellington, Dubbo, and Wagga.

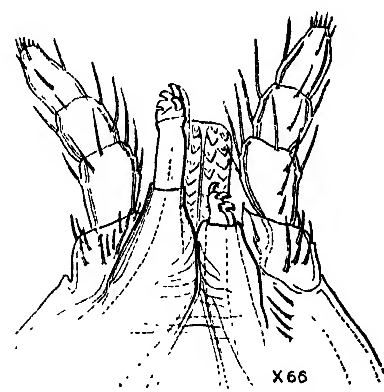
The fowl-tick is said to have originally come from America to Mildura on the Murray, and gradually spread up the river in poultry crates and packages. The habits of these pests were noted in my paper in the *Agricultural Gazette*, November, 1901, but as a good deal of fresh information has since come to hand, I propose to bring it up to date.

The fowl-tick, *Argas americanus*, was originally described from Texas by Dr. Packard; specimens from Australia sent by me to Neumann in France, were determined as this species, while others collected and forwarded by Lounsbury from South Africa, were said by the same authority to be *Argas persicus*, which is a native of Asia. The specific differences are of no particular importance to the poultry farmer, when the habits and results from the infestation are exactly the same. According to Lounsbury's report ("Fowl-tick: Studies on its Life, Cycle, and Habits") reprinted from the *Agricultural Journal* of South Africa, September, 1903, this pest is found in nearly all the towns in Cape Colony, is established in Orange River, Transvaal, and Natal, living and thriving in the coastal towns as well as inland. It is well known in Persia and India, recorded from Algeria and Russia, common in the southern and western States of North America, and the drier portions of South America. In Australia, it is plentiful in Victoria and New South Wales, but its range is limited to the dry inland districts. It was recorded from South Australia by Crawford as far back as 1887, so that there is hardly any doubt that it has spread up the Murray into the towns along the rivers in the first instance.

Considering the length of time that the fowl-tick has been living in Australia, it is remarkable that it has not spread all over the country, for as far as this State is concerned there has been nothing done to isolate or check the introduction of infested poultry or crates into the clean districts. Under the existing state of affairs it has every chance of being introduced from the west or south into the heart of Sydney, and then good-bye to the industry that our prize poultry-breeders have built up in New South Wales. The fowl-tick in its adult form is a dark reddish-brown creature of an oval

Piece of old splintered wood, infested with Fowl Tick.

form, with the back flattened and slightly roughened; the head is hidden under the body and the tips of the four pairs of legs extend beyond the rim of the body when moving about. They have very similar habits to the bed-bug; for during the day they hide in cracks or crevices between the boards, or perches in the fowl-houses; creeping out at night they attach themselves to the fowls and suck their fill of blood, afterwards crawling back to their hiding places, so that the large ticks are never seen on the poultry in the day time.



Mouth parts of Fowl Tick.

The larval ticks, which hatch out early in September (when they can be found under every bit of bark and wood about the fowl-houses), are greyish-brown, with three pairs of long legs, and are not unlike tiny spiders. It is in this stage that they do the most serious damage, for within a few weeks after birth they find their way out and get into the birds, and bury the mouth parts (which at this stage of growth project in front of the thorax and are not hidden as in the adult stage) in the skin and gorge themselves with blood until they become dull purplish black, and measure about one-

tenth of an inch in length, the body being swollen and rounded. Lounsbury found that most of them were full fed on the fifth day and ready to drop off, but others, perhaps not so favourably situated on the body for obtaining their food, remained attached up to ten days. A few hours before parting with its host it undergoes a remarkable change; the body alters in shape to the flattened disc of the adult form, and so is more adapted for the life it now leads—hidden in cracks or crevices of the fowl house and nesting-boxes. Here it rests, assimilating the blood it has gorged from the fowl, and casts its larval skin, appearing now with four pairs of legs and the breathing spiracles of the adult. Within a few days of this change, the young tick comes out and hunts for food, and if successful attaches itself to the bird and feeds upon its blood, but it always leaves its host before daylight, and hurries back to a hiding place. In about a fortnight the tick again casts its skin and appears in a fresh suit of clothes. After this moult the tick again forages round for blood, and again it retires to its hiding place, where in a few weeks it moults for the third time and appears a fully-developed fowl-tick. These mate, and the female lays its eggs in cracks and hiding places; they feed in the adult state during the summer time every month, the female after each feed laying a batch of eggs. As the winter comes round they become more torpid, and later in the season do not feed at all. The fowl-tick has come to stay, and the sooner we realise the fact and set to work to confine it to its present range, and then attack it in the infested towns the better it will be for the State. The backyard fowl-house of the ordinary householder who keeps a few chickens on the scraps, is admirably adapted for breeding ticks, as it is usually built of old packing-cases, rough pine saplings, and sheltered with worn-out corn sacks, for anything is good enough for a fowl-house. It generally rests against a paling fence with a few pepper-trees round about, in which the majority of the fowls roost in preference to their proper house. In many places there is no fowl-house, the fowls roosting on the trees or under the cart-shed, so that in a very short time ticks are carried all over the place. At Moama, I examined an old disused baker's cart under a shed in a yard, where the owner assured me there was no tick in the place, and found, on lifting up the zinc top, that between it and the wood there was a solid mass of adult ticks, from which I could have easily scraped out a couple of quarts in a few minutes. The pepper-trees, on account of their hardy nature, are largely grown in the west, and their rough resinous bark does not retain any moisture but throws the rain off, a condition that just suits the ticks, for they cannot stand water, and are seldom found on exposed walls; but wherever there are dry, sheltering, dark, crevices they congregate, and though they have no eyes they are very sensitive to light, as soon as they are exposed they crawl off under shelter. They are also endowed with a wonderful instinct for finding out fowls, though many probably go hungry for a considerable time where fowls are not numerous. Here again their powers of fasting come into play and make them a difficult foe to deal with, for they can remain shut up in a tin for nearly two years without anything to eat, and timber, fences, trees, or old disused fowl runs may be abandoned and lie idle for a year or two, but a

few ticks will survive to visit poultry when they arrive. In my former notes I had no record of fowl-ticks attacking turkeys or ducks, but I now find that both ducks and turkeys soon become infested, and die if brought into tick-infested premises in the summer.

There are hundreds of places where it is impossible to rear any young chickens or fowls, and if fowls are brought into the town yards from farms still free from ticks they will die within a week or two. The few old fowls that have been bled season after season and dipped in sheep-wash or other compounds, become immune or hardened to ticks, and then can live through everything. The method of spreading tick is not so much to be feared from the introduction of strange fowls into the clean yards, as from the old crates, boxes, and bags that may be full of tick, and still not be noticeable. The railway authorities might easily get their crates infested and carry tick all over the State, for they bring quantities of poultry at Christmas from the infested districts.

In Victoria strict measures have been taken to deal with fowl-tick, and poultry introduced from New South Wales, or other States, in which fowl-tick is known to exist, have to be accompanied by a certificate of the Entomologist or Inspectors that they have been passed as free from fowl-tick. They have now taken steps to check its spread in their own towns, and all poultry from an infested district are examined and taken to the railway station, where they are placed in crates that have been specially sent up by the buyers, and have not been removed from the station. Inspectors from the Department of Agriculture have visited Benalla and Echuca, and gone over the fowl-houses with the police-sergeant (who is appointed an inspector under the Act), and condemned every building in which he has found tick, giving the occupier fourteen days in which to pull down and rebuild the fowl-house, coat the timber with tar, remove all the palings in the fence and treat them in the same manner before they are replaced; all pepper-trees are tarred up to 6 or 8 feet, and the tops cut off, so that an inspected town where ticks are rampant in Victoria puts on a half-mourning tint. Special kinds of perches are advocated for placing in the reconstructed fowl-houses, so that tick cannot get on the birds when roosting at night. The uprights of these perches are made of gas-pipe driven into the ground; they have a funnel of tin soldered round the centre below the crossbar perch, in which oil or carbolic wash is placed; planed hardwood perches, laid crossways, rest on four gas-pipe corners protected in this manner.

Swinging perches are used in many places, slung on wires from the roof; these are greased to keep the ticks from crawling down to the perches.

The question of dealing with the tick in this State must be faced, if our poultry-breeders are to hold the place they have done for so many years in Australia; and the first thing that should be done is a strict quarantine, not only of the fowls in all infested areas, but of all boxes, crates, and bags in the neighbourhood; like the codlin-moth with second-hand fruit cases, the fowl-ticks' means of progression and extension is in crates, boxes, and bags from infested yards and not so much on the fowls. If such a quarantine

be enforced, the *bonâ fide* poultry-keepers would soon see the advantage of getting rid of, or reducing the tick in their towns, and people would have to get rid of their fowls, or house them properly; but as long as we have no regulations to deal with the matter, hotels, stores, or residences in a country town will have a few fowls running in the yard, laying in the stable and roosting in the cart-shed, so that the whole of the woodwork round the place becomes tick-infested. Where such a state of things exists, there is no reason why fowl-tick should not adapt itself to new surroundings, and invade the dwelling-house and get into the baby's cradle. There was, no doubt, a time when the bed-bug of infamous habits, was a dweller in the forests hiding under the loose bark on the tree-trunks, when it had not learnt the comfort of sheltered beds, or the advantage of living near its food supply, but it is a domestic insect now.

As I noted in my former paper, there is nothing like coal-tar to fill up the cracks in wood used for building fowl-houses; and if all material is well tarred before it is used, and the whole building treated with the same material after it is built, there will not be many holes or corners for the ticks to hide in. Whitewash or lime is all very well, but when it sets it cracks, revealing cavities into which it has not penetrated, very suitable for the home of the wandering tick.

The less wood used in building a fowl-house the better, for in most parts of Australia as long as the birds are protected from the rain and wind, they do not suffer much from cold. The idea that when the ticks are found in the place it can be closed, or pulled down, or even burnt, and the ticks so got rid of, is erroneous, if the fowls are allowed to roost in the trees, for with all rough-barked trees like the pepper-tree, as I have shown, the ticks are just as well covered as in the abandoned fowl-house, and the fowls will still suffer from their attacks.

There is something also to be said about the keeping of poultry in the back yards of the city of Sydney and its suburbs, and it would be of great advantage to the health of the community if the Inspector of Nuisances was empowered to act as a poultry inspector, and the habit of building a chicken-house within a few feet of your own or your neighbour's dwelling-house, discouraged. Even with ordinary care, in midsummer, there is a danger of wind or flies communicating disease from sick fowls or the more or less decomposed scraps fed to the poultry, for the ordinary householder only "keeps a few fowls to eat up the waste scraps." How much more so where a number of unfortunate fowls, crowded up in a few square yards of wire-netting, are cleaned up at irregular intervals. There was a time, not so long ago, when the homely pig, with his backyard sty, was quite a common object in the suburbs, but at the present time who would let his neighbour keep a pig close to his house?

Before the outbreak of plague in Sydney, I am told, on good authority, that there were quite a number of small shopkeepers in the streets of Sydney who kept a few "chookies" in the cellar and basement.

The Application of Science and of Scientific Method to Agriculture.

F. B. GUTHRIE.

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AGRICULTURE depends more directly for its progress upon the development of science than is the case with any other material art. The rapid advances made in farm-practice within recent years have been coincident with the advance of scientific knowledge, and the application of scientific facts and methods to agricultural pursuits. The day of the rule-of-thumb farmer, nourished on tradition and adopting methods handed down through the generations, is past. In order to hold his own among his competitors, the farmer of to-day cannot afford to neglect the teachings of science as far as they affect his own pursuits, and that farmer will be the successful one who is able to understand what science has to tell him, and to utilise the weapons which she places in his hands.

By this, I must not be understood as intending to imply that the farmer must be a man of science—an entomologist, a botanist, a chemist, and so forth—but I do mean that he should have an education of sufficient scope to enable him to make use of results obtained by scientific men, and to conduct his own work in the scientific spirit. For it is not only by the direct application of scientific facts that science benefits the farmer, but in a still greater degree by the application of the scientific method to farm-work; the spirit of inquiry and observation, the patient, accurate, and systematic attention to details, and, above all, in the continual use of experiment. Without this, the farmer becomes a mere sowing and reaping machine, incapable of progress, and at the mercy of adverse seasons and of more energetic competitors.

Amongst ancient peoples, and until quite recent times, agriculture was purely an empirical art; the operations of the farm were handed down as traditions from father to son, and no attempt was made to understand the principles underlying such operations.

The earliest peoples were acquainted with many of the operations which form the basis of successful farming to-day. The Egyptians knew the value of many substances as fertilisers, and were in the habit of improving barren soils by the admixture with them of more fertile ones. The value of bare-fallow and of the rotation of crops were known in very early times, but no attempt was made to explain the rationale of such operations, and to apply them systematically, until quite modern times. Indeed, this is hardly a matter

for surprise, since the principles involved could not possibly be understood until the sciences of chemistry, plant-physiology, bacteriology, &c., had advanced sufficiently to provide some kind of interpretation.

The first to establish the fundamental fact that the saline constituents of the soil constitute the nourishment of plants was Bernard Palissy, the Perigord potter. His long and arduous search for the particular saline glaze of which he was in need, led him to study more particularly the characteristics of the salts met with in the different earths, and he made the observation that the growth of plants abstracted certain salts from the soil, and that the efficiency of substances used as manure at that time, such as marl, was due to their containing certain soluble saline matters; and that the cause of the well-known fact that continual cropping exhausted the soil was the removal of the soluble salts. These are, in fact, the principles upon which our modern system of manuring is based.

General interest in the connection between science and agriculture was first awakened in France by the celebrated chemist Réaumur, who published in 1730 a treatise discussing the factors which induce fertility in different soils. Réaumur enjoyed a high reputation on account of his work in other branches of applied chemistry, notably pottery and the metallurgy of iron and steel, and his work aroused universal interest. In France several of the academies offered prizes about this time for essays dealing with the subject, and with the kindred one of the improvement of soils by admixture with other soils. Amongst the institutions which were the first to encourage in this manner the study of scientific agriculture were the Bordeaux University and the University of Montpellier. It is thus to France that the world owes the first systematic endeavour to apply scientific methods to the improvement of the soil and for the benefit of the farmer.

The position of scientific agriculture at this time and till the close of the eighteenth century is practically confined to the study of the constituents of the plants and a comparison of the constituents of the soil upon which they grew, the basis of investigation being the assumption that the plant grows by the absorption of certain saline substances from the soil.

The closing years of the eighteenth century were illumined by the startling discoveries of Priestley, Cavendish, and Scheele, and the brilliant generalisations of Lavoisier, which established chemistry as a science. In common with other branches of applied chemistry, agricultural chemistry assumed a new complexion. The names of those who took up the study of the growth and requirements of plants in the light of the new knowledge were numerous, and included some of the foremost men of science of the day.

Priestley himself, the discoverer of oxygen, was the first to identify as oxygen the bubbles of gas which are given off when green leaves are enclosed in water in a flask and exposed to sunlight This is a phenomenon of great importance in plant life. He also observed the fact that growing plants have the power of purifying vitiated air, making it richer in oxygen.

We owe our knowledge of the rationale of this process by which the green-colouring matter of plants decomposes the carbonic acid of the air under the

influence of sunlight to Jungenhousz and Sénébier. The former showed that the reaction only occurred in sunlight, and Sénébier showed that it was the decomposition of the carbonic acid which yielded oxygen, the carbon being absorbed by the plant to build up its tissues.

Alexander von Humboldt was the first to make careful and complete examinations of atmospheric air, and we owe to him our first knowledge as to the part played by its different constituents other than carbonic acid in the maintenance of plant life. So that De Saussure, in his "Recherches Chimiques sur la Vegetation," 1804, was able to state with some definiteness the sources of the various components of the plant. The carbon is obtained in the manner above described, the hydrogen and oxygen from water, and the mineral constituents from the soil.

But of all the chemists whose work was done at the beginning of the nineteenth century, none advanced the science of agriculture to the extent that Sir Humphrey Davy did. His work in connection with agriculture is quite overshadowed by his remarkable discoveries in other branches of chemistry. It marked, however, a distinct epoch, and he made agricultural chemistry a popular subject by a series of lectures on the subject. These lectures were published in 1813 under the title, "Elements of Agricultural Chemistry," which were regarded for many years as authoritative, and afford us an indication of the state of the science until the general adoption of Liebig's views. Davy was the first to undertake exact and exhaustive analyses of soils, and recognised the importance of maintaining a proper proportion amongst the various ingredients of which the soil is composed. Sand, clay, humus must all be present in fertile soils. He noted also the great importance of the power of absorbing and retaining water in relation to soil fertility. According to Davy's teaching, plants obtain their food from water and humus alone; water and humus containing all the fertilising substances necessary to support plant-life. Davy dismisses the subject of the manurial value of saline substances with the statement that as none of them provide the plant with any of the "common principles of vegetation," namely, carbon, hydrogen, and oxygen, they need never be employed, except such of them as contain carbonates, ammonium salts, or nitrates. In Davy's analyses of soils, therefore, ingredients such as phosphates, potash, and nitrogen, which we now recognise as of special importance, were not even determined.

The next notable worker in the field of scientific agriculture was the French chemist Boussingault, who was a co-worker with his yet more distinguished fellow-countryman, Dumas, in the domain of physiology, and whose researches have laid the foundation of our knowledge concerning the processes involved in the nourishment of animals and of plants, the forms in which plants obtain their nourishment, and nature of the plant-ingredients which are utilised in the feeding of animals. But Boussingault has a still more particular claim to the gratitude of those who derive their living from the soil. He was the first to institute experimental methods of research in actual farm practice. He fitted up a laboratory on his farm at Bechelbronn, in Alsace, and was the first to carry out farm operations in the field with

some approach to the exactness of scientific investigations. He realised fully, the value of experiment stations established in connection with the farm, and has the merit of having founded the first of these invaluable institutions, the spread of which has been the most important factor in modern agricultural progress. Of all the benefits which agriculture owes to science, none, I think, can compare in importance with the work of these stations, the value of which is recognised in all countries of the world. For it is here that any new theories are put to the test, and suggestions as to treatment of soil or crop can here be carried out under the most favourable conditions, and their value or uselessness ascertained. More important than all for the progress of agriculture, the farmer and the scientist can here meet on common ground, and such farms have done more than anything to do away with the prejudice that used to exist, and unfortunately still does exist here and there, against the scientific worker. The results of the experiments are here exhibited plainly in the field, open for inspection and criticism; and the farmer receives clear and ocular demonstration of the result of the comparison of different crops, different systems of soil, treatment, of rotation, of manuring, of pruning, and spraying, &c. Boussingault has the honour of having instituted the first experiment station in 1834, and he continued to enrich the science by means of experimental work until his death in 1887. He was the first to establish the scientific principles underlying the rotation of crops; he studied the effect upon production, of draining, clearing, and other operations, the question of the nitrogen-supply of plants, vine-culture, &c.

In the year 1840, the great German chemist, Liebig, published his book entitled "Chemistry in its application to Agriculture and Physiology." This publication, followed in 1859 by the same author's "Letters on Theoretical and Practical Agriculture," may be regarded as the foundation of modern agricultural science,—at least agricultural chemistry. Though much of his teaching requires to be modified in the light of more recent research, the fundamental principles laid down by him are still accepted as correct. Briefly, his teaching may be summed up as follows:—A fertile soil is one that contains all the elements of plant-food in an available form. Each crop removes a portion of these ingredients. Some are replaced by the air and water. Some are lost if not replaced by man, in the form of manure. To maintain fertility, *all* these substances must be replaced. Farm-yard manure does not replace the whole of the substance removed; some in the form of grain, hay, milk, live stock, &c., being entirely lost. He combated the view previously held as to humus being the only source of plant-food, and taught that water, carbonic acid and ammonia, derived from air, are the essentials necessary for the growth of plants. These are supplemented by salts supplied to the plant in aqueous solution by the soil. Plants can be grown in the total absence of humus, and require only air and water holding certain salts in solution. He recognised in particular the importance of phosphates in the nourishment of crops, and we owe to him the important discovery that when bones or mineral phosphates are treated with sulphuric

acid (that is, converted into superphosphate), the phosphoric acid is now in a form in which it is absorbed with great readiness by plants. This discovery entirely revolutionised the prevalent methods of manuring, and created a new and important industry, which has to-day become one of the largest of the branches of applied chemistry, namely, the manufacture of artificial fertilisers, with superphosphate as a basis. Liebig was, at the time of the publication of his work, the leading scientific authority in Europe, and his views commanded immediate and universal attention. In Germany, the Government recognised at once the importance of extending assistance to the study of scientific agriculture. Courses were instituted at several of the Universities, and State experiment stations founded where field experiments could be carried out under ordinary farm conditions. Other countries quickly followed the good example they set, and agricultural colleges and experiment farms sprang up everywhere. It is to the universal spread of these institutions that we owe the enormous improvement in agricultural practices.

The history of modern progress in agriculture is contained in the records of the public and private experiment farm and stations, principally in Germany, France, England, and the United States of America. In the United States particularly, the authorities have been quick to realise the importance to the farmer of scientific aid. Since 1875, when the first of these institutions was founded under the Hatch Act, they have multiplied with great rapidity, and there are now over fifty experiment stations whose work is exclusively devoted to scientific research work in agriculture, and over fifty Universities and colleges having courses in agriculture provided in their curricula, a considerable number of which are colleges devoted exclusively to agriculture. In many cases the college and the experiment station are the same institution, several of the colleges (Amherst, for instance) having experiment stations attached. It is impossible to avoid the reflection that the enormous growth of these institutions in America, and the important part played by the Department of Agriculture in that country, is a matter that merits our serious consideration. The Americans have a tolerable reputation for shrewdness, both in their private and national undertakings, and it is not easy to believe that they would continue to expend money on institutions that did not pay, or in pursuit of a policy that "cuts no ice."

Of the private institutions of this nature, none has done more for agricultural progress nor enjoyed a more deserved reputation than the Rothamstead Experiment Station, founded by Sir John Lawes. The Rothamstead Station may be said to date from 1843, when Sir John Lawes associated with himself the distinguished chemist, Sir John Gilbert. Sir John Lawes had been working by himself for about ten years previously, and it is thus only a very little, if at all, younger than Boussingault's station, but it has far surpassed the older one in the value of the work done and the length of time over which its operations have extended. Sir John Lawes has bequeathed Rothamstead to the nation to be managed by trustees, and has endowed it with the

sum of £100,000. The Rothamstead experiments will remain for all time a model for the conduct of such work, and include field investigation as to the efficacy of different manures and methods of soil-treatment, rotation of crops, feeding of animals, fixation of nitrogen, and, in fact, experiments of all kinds calculated to result in improved methods of farming.

In the foregoing brief summary of the progress of scientific agriculture, I have confined myself to the main lines of investigations, developed by different workers up to the time when agriculture ceased to be empiric, and was founded by Liebig on definite scientific principles. In those days the only science that was of much assistance to agriculture was chemistry, and it still remains the most important one to the farmer, both because of the light which it can throw upon the principles underlying farm-practice, and because of the humbler service which the analyst performs in the analysis of fertilisers, soils, and farm produce generally. It has not been with the idea of magnifying the chemist's contributions that I have laid so much stress hitherto upon the chemical questions, but simply because in the historical development of the subject the fundamental questions were the first to be discussed, and these are chemical ones.

Fixation of Nitrogen, &c.

Among special questions the study of which has resulted in most important advantages to the growth of agriculture is that of the plant's supply of nitrogen. We owe the solution of this question to the science of bacteriology. It had long been known that the addition to sterile soils of relatively small quantities of other soils was capable of rendering the former fertile. This was found to be accompanied by an increase in the amount of nitrate (salts of nitric acid). The discovery by Pasteur of organisms inducing different kinds of fermentation showed the way to a rational understanding of this phenomenon. Pasteur himself surmised that this gain in nitrates was brought about by the development of micro-organisms. In 1878 Schloesing and Müntz in France were able to prove that this was the case, and that certain nitrifying organisms were capable of converting ammonium salts in the soil into nitrates. These organisms were isolated by Winogradsky, who separated two distinct groups, one of which converts the ammonium compounds into nitrites, while the second carries the oxidation a stage further, and produces nitrates.

The question whether plants are able to absorb the nitrogen of the air directly by means of their leaves was, for a long time, a vexed one, and nearly every investigator of distinction gave his attention to this subject. The question can hardly be said to be definitely cleared up to-day, but the theory now accepted is that plants do not absorb nitrogen by means of their leaves, but that one class of plants, the leguminosæ, have the power of assimilating, by means of their roots, the free nitrogen contained in the interstitial air within the soil. The German chemists, Hellriegrel and Willfarth, were the first to establish this highly interesting and important fact, and they proved that true assimilation was effected by the agency of bacteria inhabiting the root nodules of leguminous plants, such as clovers, peas, &c.

These investigations have not only been of the very greatest value in enabling us to understand the principles underlying such operations as the rotation of crops, and to place them upon a systematic basis, but they bid fair to indicate a means of directly increasing the fertility of the soil by the direct application of the organisms involved.

Many attempts have been made to prepare pure cultures of some of these nitrifying organisms, and to inoculate the soil with them. The most successful attempts have been with the root-nodules of leguminous plants. Professor Nobbe, of Saxony, prepared cultures of these bacteria, which were and are still on the market under the name of "Nitragin." These have been used often with success for inoculating soil on which the host plants did not make good growth. More recently Dr. Moore, of the United States Department, has prepared, by a somewhat different process, cultures of these organisms, which it is claimed have produced the most remarkable results in farm practice. It is yet rather early to pronounce on the success or non-success of these cultures. They are being experimented with, probably, by every agricultural department or station in the world.

The free nitrogen of the air can then be utilised directly by certain plants in the manner mentioned. The majority of cultivated plants, however, derive their nitrogen from nitrates and ammonium salts in the soil. A point of the very greatest importance to us is—can we by any means reproduce artificially this nitrogen absorption? Can we convert atmospheric nitrogen into a form in which it can be absorbed by the plant? The importance of this question is enormous, for nitrogen is one of the substances which is absolutely essential to plant growth, and is one which most crops (legumes excepted) have a difficulty in utilising in the form in which it is present in the soil. It is, therefore, continually applied in manure. Substances like stable manure, blood, bone-dust, sulphate of ammonia, and nitrate of soda, owe their efficiency to the nitrogen they contain. But nitrogen is a very difficult substance to catch and force into combination with other elements. In the air, as you know, it exists in the free state, and it is characterised by a highly aristocratic exclusiveness, a strong disinclination to mix with socially inferior elements, a characteristic which is so marked that even when it has been coaxed into combination—such, for example, as nitro-glycerine, nitro-cellulose, picric acid, &c., it liberates itself on the slightest provocation with violent explosion. On account of this aloofness it has not yet been possible to devise a means by which atmospheric nitrogen can be made to combine readily and cheaply in such a form as to be available for plant-food when applied to the soil.

Recently, however, what looks like a possible solution of the question has been discovered. When air, from which the oxygen has been removed, and which may be regarded as practically pure nitrogen, is passed over calcium carbide at a white heat, it combines, forming a compound known as calcium cyanide. This is a fine black powder which is decomposed by water into ammonia.

The crude cyanide has been found to possess manurial value, due, no doubt, to the liberation of ammonia by the soil-moisture. Too few experiments have as yet been tried with this substance to settle the point as to whether it is likely to be an effective substitute for sulphate of ammonia.

Dr. Hall, of the Rothamstead station, has reported a trial with mangels, swedes, and mustard. He reports that the trials do not warrant any definite conclusion as to its comparison with sulphate of ammonia, for example, but finds it to be an effective nitrogenous manure. But even if we have not yet got the desired substance, there is little room for doubt that experiments along this line will result in the preparation of a cheap fertiliser from the practically limitless expanse of air. English people will be pleased to hear that there is already a company, connected with the Cyanid Geselschaft in Berlin, where this substance is being prepared—at present, only at the rate of about one ton per day.

Another method by which attempts are being made to obtain a cheap supply of nitrate from the air is by means of electricity. As you are aware, when air is "sparked," nitric acid is formed by the direct union of the nitrogen and oxygen. This happens always in the neighbourhood of electrical machines, and during storms the flashes of lightning cause this combination; so that the air during a thunderstorm always contains small quantities of nitric acid. Attempts are being made to utilise this action on the manufacturing scale, converting the nitric acid so formed into nitrate of soda.

The solution of this problem is simply a question of cheapening the unit-cost of the electric current. Sir William Crookes has calculated that if the cost could be reduced to $\frac{1}{17}$d. per Board of Trade unit, which is quite possible when large natural sources of power like Niagara are used, the cost of nitrate of soda need not be more than £5 per ton. Up to now it has not been possible to manufacture "electric nitrate" at a rate to compete with the natural nitrate of soda.

Another highly interesting application of electricity to agriculture lies in the possibility of inducing the growth of crops by the direct electrification of the soil or of the air. Professor Lendstrom has published some exceedingly interesting experiments which he has made in this direction, and which point conclusively to the fact that plants growing on an area artificially electrified attain more vigorous growth than in the case of plants not so treated.

Implements.

Improvements in the implements used on the farm have been, of course, directly due to the advance of scientific knowledge. The replacement of the wooden implements used by the earlier nations by implements of iron the use of steel, and the introduction of steam and electricity as motive-powers, mark the main epochs of improvement in this respect. The plough, to take an example, although not differing in its essentials in its modern form from that used by primitive peoples, has undergone many improvements in its constituents, partly due to the introduction of steel, and of increased mechanical knowledge, partly, on the other hand, due to increased knowledge of the

peculiarities of the soil, and the functions which can be performed by the plough. Share, mouldboard, coulter, have all undergone modifications, and, recently, the type of mouldboard plough has been, in some instances, replaced by the disc plough, provided with revolving discs. The subsoil plough is also an introduction of recent times. This plough is provided with a share attached to the beam, and set to a lower depth than the ploughshare. This follows behind the plough, and breaks up the smooth-pressed surface left at the bottom of the furrow, thus loosening the earth to a greater depth and enabling the roots of the plant to penetrate further in search of food and moisture.

The introduction of steam, and the advanced application of mechanics, have introduced all kinds of machinery to replace manual labour. Sowing, cultivating, reaping, threshing, winnowing, &c., are now all done by machinery. The increased improvements in machinery and in mechanical contrivances have introduced the possibility of sowing both seed and manure in drills, thus effecting a considerable saving in the quantities used. The advent of the motor is likewise effecting a revolution in farm-practice. Motor-ploughs, motor-harvesters, &c., are coming into use.

Improvement in Plants.

Another direction in which the application of science has enriched agriculture, is in the improvement of farm crops and animals, by selection and by cross-breeding. The present high quality of our staple product, wool, is an instance which is familiar to you. The improvement of the sugar-beet is another instance of an industry, the enormous growth of which is entirely due to the application of science—in this instance, of chemistry. The original of the sugar-beet of to-day—the white Silesian beet—contained about 6 per cent. sugar; the improved varieties at present cultivated have a sugar content of over 20 per cent. In the improvement of the sugar-beet the name of Vilmorin is best known as the originator of the modern varieties. The manufacture of sugar is essentially a chemical process, and the improvement of the beet has been, as I have intimated, entirely due to the application of chemistry. Vilmorin's method of selection consisted in taking, by means of a gouge, a small cylindrical piece from the roots while growing in the ground, and utilising for seed purposes those plants whose roots showed the highest sugar-percentage. We owe to Vilmorin, also, our improved parsnip, carrot, radish, &c., from the wild plants of these varieties.

The improvement of wheat, the staple food-grain of so many countries, has also engaged considerable attention, and whatever permanent success has been achieved has resulted from the application of scientific methods of investigation. Till recently, inquiry was mainly directed towards attaining larger grain and more prolific varieties—qualities which appeal more immediately to the grower.

Messrs. Garton Bros., amongst others, have attained considerable success in this direction. Very notable work has, however, been achieved recently in New South Wales, by one whose name is, no doubt, familiar to you—Mr. Farrer.

Mr. Farrer was the first to approach the subject in the true scientific spirit, and the result is, that while the improved varieties produced by other workers are of more or less local interest only, Mr. Farrer has already achieved notable results, which promise to be of a permanent nature. His objective is only in a minor degree the production of an attractive and prolific grain. The problems set himself are, practically, three in number:—

1. To produce types of grain suitable for the different climates met with in New South Wales—particularly to produce a grain suitable for a dry climate such as we have in the Western Division of the State.
2. The production of a variety which shall resist or escape rust, a disease which causes much damage to our crops year after year.
3. To improve the milling-qualities of our wheats, and to ensure, in the case of all new varieties produced, that they shall be of a high standard for milling.

It is this last aspect which differentiates Mr. Farrer's work from that of others, and gives it its peculiar importance. It has too frequently happened in the past that new and very promising varieties have proved disappointing, because they have gradually deteriorated in their milling qualities, or give flour of poor quality. There is no advantage in increasing the yield per acre if the grain harvested commands a lower price or is unsaleable.

Mr. Farrer, by paying particular attention to this point, has not only succeeded in maintaining a high milling standard in his cross-breeds, but has produced new varieties of much greater value to the miller than any that were previously in cultivation.

The question of the production of a grain that will resist rust is, I believe, satisfactorily solved. The question of a payable wheat for the rainless west cannot yet be said to have been solved, though some of Mr. Farrer's cross-breeds do far better in these districts than those hitherto cultivated. It may be that some of the varieties produced may become acclimatised, or that some as yet unformed variety may be found to satisfy the requirements.

Potatoes.

The potato is another crop which has been subjected to scientific improvement of recent years. Quite recently varieties have been produced which command fabulous prices for seed. As much as £2,000 per ton is paid by the farmer in the assurance of an enormously increased yield of tubers and their higher value on the market.

Vines.

Of similar nature to the question of rust-resisting wheats is that of vines capable of resisting the attacks of the phylloxera. In Europe, not many years ago, enormous areas of vines in Southern Europe were destroyed by this pest, which threatened the wine-production of France and Italy. Here also a remedy was found in a vine which grew in the United States, and was

immune from the attacks of the pest—was, in fact, phylloxera-resistant. By grafting the wine-producing grape-vine upon phylloxera-resistant stock, it was found that, while the wine-producing power of the vine was in no way affected, the grafting had imparted to it the power of resisting phylloxera.

We are benefiting from this discovery in New South Wales. As you doubtless know, considerable areas of vineyards were destroyed a few years ago in New South Wales by the phylloxera, or had to be compulsorily destroyed to prevent its spread. These are now all being restocked with phylloxera-resisting vines, a nursery for which is being maintained by the Department at Howlong, under the superintendence of Mr. Blurno.

Fruits.

In the improvements of fruits many triumphs are to be recorded—in the production of more prolific varieties, larger fruits, and in some instances of seedless varieties, as well as in the production of new fruits, as the result of the combination of two different kinds. In this connection, the work of Mr. Luther Burbank has been very prominently mentioned lately, and there is no doubt that some of the results obtained by him are extremely interesting and remarkable.

Insect Pests and Fungus Pests.

In the incessant fight which the farmer has to wage against insect and fungus pests of all kinds he calls in the aid of the sciences of Entomology and Chemistry. In some cases, as in those just mentioned, resistant varieties exist, and by crossing with the susceptible plant immunity can be conferred on the latter. In other cases, the life history of the insect or fungus has to be studied (the province of the entomologist and the vegetable pathologist), and remedies applied which are based on a knowledge of the habits and peculiarities of the pest. In other cases the chemist is called upon for the preparation of insecticides and fungicides—poisonous sprays which act in various ways.

Of recent years, especially for orchard work, fumigation has been largely adopted. This is done by enveloping the affected tree in a tent and liberating prussic acid gas, an extremely powerful poison, within the tent. This is also the best and most approved method for treating fruit affected with scale, especially for export.

Still another method for combating insect and fungus pests is the search for parasites which feed upon the pests, the theory being that by the introduction of a parasite which feeds upon any particular insect, the host will be, if not exterminated, at least kept in check. This method has succeeded admirably in two notable instances—that of the Gypsy Moth and the so-called Cottony-cushion Scale in the United States; and though the matter is one involved in innumerable difficulties, it is not too much to hope that the method may prove successful in some instances, though probably not of universal application.

Feeding of Farm Stock.

The proper feeding of farm stock is another subject to which attention has been paid in recent years. Like the breeding of plants, the art of feeding animals is based on definite scientific principles, and in up-to-date farm management the rations for farm animals are devised and prepared with the same care as is devoted to the manures for crops.

When it is remembered that the food best adapted for any animal varies with the purpose for which it is fed, and with its age, it will be at once realised that there is scope for a very great variation in the rations, and a very careful consideration of the object for which it is given. The food-requirements of a draught ox, a milch cow, and an ox which it is intended to fatten, present features of distinct difference which all have to be taken into careful consideration if the food applied is to be used to the best advantage, most economically, and without waste.

The question is one which cannot be said to have received the consideration in New South Wales which it deserves, the feeding of dairy-cattle being probably the only direction in which it is pursued on anything like scientific lines, although the question of the proper feeding of sheep in times of drought, when artificial feeding has to be resorted to, is one of the greatest importance to pastoralists, and one that consequently assumes national importance.

Even the question of the feeding-value of our different native scrub-plants has only been touched on in a superficial manner.

Dairying.

Of special agricultural industries, dairying has, in particular, been affected by the adoption of scientific methods to an extent that has brought about a complete revolution in the system of dairy-farming, so that the dairy-farmer of twenty years ago would hardly realise for what purpose a modern butter-factory was intended. He would find the place filled with machinery for separating the cream and for handling it and making the butter, with thermometers, test-tubes, and burettes, and all kinds of chemical apparatus, strange-looking bottles with chemical labels, centrifugal machines, pasteurising apparatus, &c.; and he might easily imagine himself to be in the testing-room of an engineering laboratory.

The introduction of the Laval separator first made possible the establishment of co-operative butter factories, and the invention of Dr. Babcock's machine for determining butter-fat in milk and cream made it possible to test rapidly and with certainty a very large number of samples of milk or cream, and determine their fat percentage—an operation that by chemical methods is too technical and slow for factory work. This invention made it possible to purchase milk on its fat content; in other words, to pay only for the cream which it contained, and thus entirely revolutionised butter-making.

Milk being especially favourable to the development of organisms of all kinds, the help of the bacteriologist is of the first importance in devising means both for preventing contamination, and for propagating the particular organisms which impart the required flavour and ripeness to butter and cheese.

Viticulture and Tobacco-curing.

Are also agricultural industries in which the sciences, and particularly bacteriology, play an ever-increasing part.

Apart from the proper soil, treatment for the vine, manuring, &c., the treatment of the must and the manufacture of wine is becoming more scientific and less empirical, according as the nature of the operations involved in wine-making become better known, and viticultural chemistry and bacteriology have become distinct branches of applied science. The use of *levures* or yeasts for the production of desired bouquets or flavours requires skilled bacteriological knowledge.

If I have succeeded in properly presenting my subject to you, you should have realised that science plays an extremely important and continually increasing part in every department of the modern farmer's life, and that its teachings cannot be neglected by the farmer who wishes to succeed. Any State which aims at improving the condition of agriculture within its borders is bound to encourage the dissemination amongst the farmers of the scientific principles underlying farm operations, and to keep them in touch with the latest experimental work, which may have a value to them in improving their farm practice. This can be done by means of colleges and experimental farms, by encouraging farmers to carry out experiments on their own farms, by lectures, and by publication of work done here and abroad, the results of which are of value to the farmer. The enormous advance in agriculture in Germany, Denmark, and the United States, of recent years, has been due less to the fiscal policy of the Government than to the universal dissemination of education, and the application of scientific methods.

Nobody deprecates more than I do the idea of stuffing the farmer with a mass of technicalities which he is unable to understand; but there is a vast difference between this and the opposite policy of withholding from him altogether the results of scientific investigation. My experience of the farmer is that he is a person of some intelligence, and quite capable of rejecting what is of no value to him; but if we propose to assist him in his occupation, we shall achieve that end far more surely by inculcating the scientific spirit of investigation, by giving him and his sons access to colleges and experiment stations where scientific work is being carried on, and by encouraging him to conduct all his own operations in the spirit in which scientific experiments are carried on, than by any amount of legislative enactments in his favour; for, after all,—if I may be permitted to repeat a remark which I have made before on another occasion,—however much legislation may favour or hinder commerce and industry, the commercial or industrial pre-eminence of a country depends finally upon the energy and the intelligence of its people; and it is in the facility given to scientific research, and the diffusion of scientific knowledge, that the real foundation of the future prosperity of a country depends; and this applies with especial force to agriculture, progress in which is, as we have seen, so intimately bound up with scientific progress.

Sheep at Bathurst Experimental Farm.

R. W. PEACOCK.

THE experiments in connection with cross-breeding have been continued at this farm throughout the year. The number of sheep at present carried is as under :—

Ewes	264
Rams	6
Wethers	24
Hoggets	98
Lambs	268
Total	660

The lambs marked averaged exactly 100 per cent. As a basis for the experiments, merino ewes were mated with Shropshire, Southdown, Lincoln, Border Leicester, and English Leicester rams. A number of hogget ewes were held over from the previous year of the various crosses, as a basis for further experiments upon the second crosses, the results of which are not yet available.

Of the first crosses, pens of the following were exhibited at the Sheep-breeders' Show, held in Sydney, 1905 :—

		Average live weight. lb.
Lincoln merino wethers	19 months	154
Border Leicester merino wethers	18 ,,	144
Shropshire ,, ,,	18 ,,	142
Southdown ,, ,,	18 ,,	135
English Leicester ,, ,,	18 ,,	135
Shropshire ,, lambs	5 ,,	82
Border Leicester ,, ,,	5 ,,	76
Southdown ,, ,,	5 ,,	74
English Leicester ,, ,,	5 ,,	70
Lincoln ,, ,,	5 ,,	67

The autumn was an exceptionally bad one, and it was found that on the short keep the Downs crosses did better than those of the long-wools. If the weights of the lambs are divided by two, a fairly accurate estimate of their dressed weight would be gained, as lambs in fairly good condition lose about 50 per cent. when dressed. The lambs dropped in the spring suffered when being weaned owing to the drought.

The following average weights of the fleeces of the various crosses should prove an index to the values of the crosses as wool-producers. The weights are for the 1905 clip, including the bellies.

			Average. lb. oz.
Merino ewes ...	..	4 and 5 years ...	8 3
Lincoln-Merino ewes	..	4-tooth ...	9 10½
Border Leicester—Merino ewes ...	...	4 ,, ..	9 2
English ,,	,, ,, ...	4 ,, .	8 11
Shropshire	,, ,, ...	4 ,, ...	8 0
Southdown	,, ,, ...	4 ,, ...	7 8
Lincoln	,, wethers ...	4 ,, ...	12 0
Border Leicester	,, ,, ..	4 ,, ...	11 12
English ,,	,, ,, ..	4 ,, ..	10 8
Shropshire	,, ,, ..	4 ,, ...	10 8
Southdown	,, ,, ..	4 ,, ...	8 12
Lincoln	,, hoggets ..	12 months ..	8 13½
Shropshire	,, ,, ...	12 ,, ...	7 12
Border Leicester	,, ,, ..	12 ,, ..	7 10
English ,,	,, ,, ...	12 ,, ..	7 7
Southdown	,, ,, .	12 ,, ...	6 12

The following is a report upon the 1904 clip, by Mr. Alfred Hawkesworth, and my thanks are due to him for the trouble he took in preparing it:—

"Southdown Stud Ram.—A typical ram's wool of its breed. Whilst showing great quality, there is sufficient robustness most necessary for a sire. There is a uniform length all through, the staple being well formed, free, and compact to the tip. Fibres are perfectly sound, with the correct undulating, wavy formation. For a Downs wool, the texture cannot be improved; and I think, if crossed with good merino ewes, the progeny would give an excellent fleece, both as regards quality and quantity. It is a good yielding wool, fully 62 per cent. when scoured, with a 50's spinning count.

"Merino Stud Ram.—An excellent type of a medium to fine merino wool, very even in length and quality, excepting a small part of the thigh or breech. Staples are free, fairly bold, showing a true merino character from the shoulder to the breech. For breeding purposes, this ram is symmetrical and has a good constitution. There should be good results if mated with suitable ewes. Spinning quality, 70's; clean yield, 44 per cent.

"Merino Ewes.—Many of these fleeces are evidently off ewes that have seen their best days, the growth being stunted, with weak backs, still showing good merino character. Some fleeces are well grown, sound, free, and full of quality from tip to base of staple, denoting good breeding. Although of nice quality, there is a desirable amount of robustness, with a good crimpy formation. Average spinning counts, 64's; yield, 42 per cent.

"Southdown-Merino Half-breds.—These fleeces must be divided into three classes, as there are some really good and some inferior, and I will take those with numbers first so as to serve as a guide. Nos. 80 and 74 can be placed first, and are an excellent type of half-bred wool of this cross, just the sort to take the place of our strong merino wool. There is a good length with a free staple, showing much of the merino character, a very desirable property in cross-bred wools, and which make them of considerable value for manufacturing purposes. Spinning counts, 60's; clean yield, 55 per cent.

"Nos. 75, 77, 83, 81, 78, 79.—These fleeces were of a very useful class, both from a breeders' and manufacturers' point; very little inferior compared compared with Nos. 80 and 74. The difference rests in appearance, the former being superior and these fine. Spinning counts, 56's; clean yield, 55 per cent.

"Nos. 76 and 82.—I would not advise these to be used for breeding purposes, the wool being open, light, straight-fibred, and only fit for low hosiery goods. There is a want of body and style in the wool. Spinning counts, 50's; clean yield, 52 per cent.

"The rest are very useful wools, fitted for the manufacturer, and are better than Nos. 76 and 82. The growth is even, quality good, and fair weights. A sound commercial wool. Spinning counts, 56's; average clean yield, 54 per cent.

"Shropshire Downs Ram.—From the appearance of the fleece, I would say that this ram has seen its best day, as the wool is irregular in growth, the quality varying, back thin and weak, breeches rough and large; the whole fleece being in a hungry condition. Is fit for low hosiery yarns."

[NOTE.—This ram is aged, and a young ram has been purchased to take his place.—R.W.P.]

"Shropshire-Merino Half-breds.—Nos. 12, 68, 71, 69, 70, 67.—These numbers are placed in rotation according to merit, forming a real useful type of wool from both a breeders' and manufacturers' point. There is mostly a good, sound, healthy growth, the staples are of combing length, of nice quality, showing an even crimpy formation. A real good commercial wool. Spinning counts, 54's; average clean yield, 64 per cent.

"Nos. 66, 1, 64, 65.—Taking these wools as a guide, I would not advise the sheep to be used for breeding, that is if good progeny is expected. The wool is mostly thin, light, and does not show much breeding. This class of wool is not of that stamp a farmer requires, and can only be grown at a loss. Spinning counts, 50's; clean yield, 57 per cent. The wether hoggets of this cross show a decided improvement upon the last lot, and is a well-grown type of wool. It has a lengthy, sound staple, with an even crimp from base to tip, the merino strain being very distinct. This is a good payable class of wool to grow, and I would say in this case the cross is a success.

"Shropshire-Merino Half-bred, 4-tooth.—This wool does not give justice to this cross, being short, thin, and mushy or wasty. It might be taken for a Southdown cross. Spinning counts, 60's; clean yield, 60 per cent. It is a hosiery wool.

"Lincoln Stud Ram.—Is one of those sound well-bred wools a breeder likes to see on a sire, having a good amount of masculinity, body or substance, still full of quality. There is a great depth of a bold, firm, commanding staple, showing a typical even wave and a nice glossy or lustrous appearance. It is a commendable class of Lincoln wool.

"Lincoln-Merino Half-bred Ewe Hogget.—Nos. 37, 36, 38, 39, 43, 42, 40, 34.—These numbers are arranged according to quality. The two first are exceptionally fine for this cross, and could be sold for come-back wool. I

consider all these fleeces are full of merit, and form most useful and valuable grades of cross-bred wools, the merino character showing out distinctly, whilst the Lincoln length and colour are pronounced. As a commercial wool, it is a commendable style, and would realise extreme rates if in quantity. There is sufficient body and stamina to recommend the ewes for experimenting purposes, and it would be interesting to see the result if crossed again on to the merino. Spinning counts from 60's and 44's; clean yield, 58 per cent.

"Nos. 35, 44, 41.—These are the faulty wools, and do not show the true characters of the cross.

"The Wether Hoggets.—There are many useful and serviceable grades of wool of a good paying class. As regards length, colour, and quality, there is nothing wanting. Spinning counts, 46's; average clean yield, 56 per cent.

"English Leicester Ram.—This is a fairly good specimen of a ram's wool of this breed. There is an average length of a nice even growth, the staple being well formed and wavy, showing a true silvery lustre. A want of density is the only drawback. Spinning counts, 36's; clean yield, 62 per cent.

"Leicester-Merino Ewe Hogget, Half-bred.—Nos. 55, 63, 61, 56, 62, 59, 51, and 60. These numbers are classed according to merit, and form an exceptionally high grade of cross-bred wool, mostly leaning to the merino, yet showing the length and brightness of the Leicester. As an even well-grown wool, full of quality and soundness, there is little to be desired. Spinning quality from 44's to 56's; clean yield 57 per cent. No. 58 of the last cross is the only faulty sample of the above collection, being of a rather spongy open nature, with a rather straight formation. Spinning counts, 40's to 44's; clean yield, 59 per cent.

"Leicester-Merino Half-bred Wether Hoggets.—These wools vary much more than the ewes, both in quality and length, especially on the backs. Two of the fleeces were very desirable commercial types, whilst the remainder were faulty both in length and style. Spinning counts, 44's to 60's; yield 55 per cent.

"Border Leicester Ram.—This wool is of a robust type for this breed, showing a massive staple and too much lustre, leaning to the pure Leicester. The Border Leicester type of wool is a demi-lustre, meaning half-lustre. It is a useful type of wool, and would give good results for the manufacturer. If used for breeding pure Border Leicesters, this ram should be mated with the finer-wooled ewes. Spinning counts, 36's to 40's; clean yield, 63 per cent.

"Border Leicester Half-bred Ewe Hoggets.—Nos. 47, 50, 48, 49, 46, and 52, are arranged according to merit, representing the finer to the lower grades. As crossbred wools these fleeces are very stylish showing plenty of the merino character, still having a sound healthy growth from the finest to the strongest. From a breeders' and manufacturers' view their quality and weights are most satisfactory. Spinning counts, 36's to 46's; clean yield, 60 per cent. Numbers of the same breed 53, 45, 54, and 51. Evidently these wools have suffered on account of the ewes being good breeders, throwing twins, &c., others from this cross being twins. There is not that style or

growth in these wools, as in the first noted of this cross, and are more of a hosiery grade than a combing class. Clean yield, 57 per cent. The wethers of this cross have given fleeces of a most useful and commendable grade, lengthy, bold, sound, bright, free, robust, but still full of quality. As a commercial wool there is nothing wanting. Spinning counts, average 50's; clean yield, 58 per cent.

"Shropshire-Border Leicester-Merino Ewe Hogget (twin).—This is not unlike a half-bred Shropshire-Merino, and would pass for the same in the wool sales. Evidently the Border Leicester has not imparted that strain, both brightness and length is wanting, and the fibre takes after the Shropshire strain."

The above figures and remarks should be helpful in drawing conclusions respecting the merits of the various crosses. The principal object of the experiments is to provide data which may be helpful to the farmers in the production of lambs for export. With this object in view the following recommendations are repeated (*vide Agricultural Gazette*, February, 1905, pages 146–8):—

"It is preferable to breed from six-toothed ewes which have already dropped one lamb, as younger ewes losing their teeth cannot do justice to their lambs if the seasons are at all unfavourable. Breed from fair to good ewes, old culls will not give satisfactory results. Half-bred ewes make better mothers than pure Merinos, having a larger percentage of lambs, which they rear more satisfactorily. Lambs should be ready for sale at from four to five months; to ensure this, green food should be provided for the ewes during the winter, and also the dry summers. Lambs for export should weigh from 30 to 40 lb. dressed weight. In choosing English rams for mating with Merino ewes, large heads should be avoided, if possible, without sacrificing masculinity. The crosses strongly to be recommended for the conditions of this district are those from Lincoln-Merino, half-bred ewes, and from Border Leicester-Merino, half-bred ewes mated with Shropshire rams. Good rams of the various breeds should be used. Good lambs must have good mothers, and good mothers must have good pastures, or substitutes for them."

These sheep are carried upon the farm in conjunction with the various operations, all of which are carried out upon an area of under 700 acres in extent. Crops such as rape, tares, scarlet clover, cowpeas, &c., being grown in rotation with wheat and other cereals, such crops being turned to profitable account in this direction, as well as being the means whereby fertility is retained.

Ploughing under Rape at the Bathurst Farm.

R. W. PEACOCK.

In the profitable retention of the fertility of the soil at the Bathurst Farm, rape plays an important part. For the sheep carried on the farm an area of rape is sown in February upon the basis of ten sheep to the acre. By the end of April it is ready for the sheep, which are grazed upon it throughout the winter and early spring. During October, when other feed is available, the crop is let run up to flower and is ploughed under early in November before the seeds sufficiently mature to germinate. A crop of green stuff

Ploughing under Rape at the Bathurst Farm.

4 to 5 feet high is thus ploughed under which becomes available as plant food for the following wheat crop. The physical condition of the soil is improved and its water-holding capacity is increased. Excellent results follow such methods; from 30 to 40 bushels of wheat being obtained per acre. The standing crop is ploughed under with the aid of chains. One end of a chain is attached to the right beam of the plough and the other to the left, and is of sufficient length for the loop formed to lie in the furrow just in front of the fresh sod falling into position. The loop pulls the standing crop into the furrow, it being covered by the furrow slice before it has time to rise. On a single furrow plough one end of the chain is attached to the beam in front of the coulter, and the other end to the swingle-bar of the furrow horse, the loop being in the same position. Other green crops may be covered similarly.

Ducks and Duck Farming

[Continued from page 1242.]

D. S. THOMPSON,
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VII.

FEEDING.

THE general management of a duck farm is simply a question of how to run a duck farm, with a view of making it a profitable investment. It has already been pointed out how a duck farm can be started and successfully run with a very small capital invested. Yet it may be stated that ducks will respond to a more liberal investment of capital, the same as any other kind of stock. The man who can afford to build a duck-house to hold a large number of ducks, divided into sections with wire divisions only, thus dividing the ducks into

Open-front Duck House.

lots of twenty, with grass runs immediately behind the shed, the building to stand facing the north-east, with wire front, and solid back and roof only; the ducks shut up in this house nightly (they will not resort to it themselves, no matter how much more comfortable it is than out in the cold and wet), bedded on plenty of straw, with plenty of drinking water from a spout running the whole length of the building, plenty of dry feed in their troughs, and fed at regular intervals with mash and meat, and only allowed out after the keen cold of the winter nights had gone; but while this can be done, and extra profits obtained, yet the man with very limited capital has a much better chance of succeeding in duck farming than in many other pursuits.

The general farmer to-day will tell you poultry-keeping will not pay, and that they are only a nuisance about the place, yet he drags on to the wheels of the public coach by keeping a lot of barndoors, of all ages, and with as many males as females, allows them to roam promiscuously, roost anywhere, and lay when and where they like. When they do lay in spite of his careless efforts to stop them, he sends some of the children round to pick up the eggs they may see lying about, boxes them up, and sends them into the market. Then, again, the fowls and the ducks that he has running about the farm, just because they are a nuisance to him, have persisted in laying in some out-of-the-way spot, and a few old broodies have found them and hatched out a number, and as they are getting rather numerous for his liking, he gets some, of the boys to box up a hundred or two and send them into Sydney to fetch anything they will bring.

The general farming community to-day are just as great in their unbelief in regard to profitable poultry farming as they were many years ago. Yet there is no one who would benefit more from scientific poultry farming than the general farmer. He already has his farm under cultivation, and the growing of crops has been a success with him.

Since the suitability of green food, in conjunction with different kinds of grain, has been established, the feeding of fowls and ducks is much easier solved than it was years ago, before the feeding of green crops to poultry was understood. Any farmer could live without having recourse to outside sources of food supply for the cultivation of ducks. If settled in a wheat-growing district, he could grow wheat and, perhaps, lucerne, and this combination would be all that is necessary to raise ducks. The wheat could be boiled and crushed up with the green cut lucerne. If settled in a maize-producing district maize could be grown, and with the combination of lucerne, a good evenly-balanced ration could be struck for profitable duck rearing. Lucerne is a fodder which, although for many years used for other stock, has only recently come into use as a poultry food. Dry chaffed lucerne makes an excellent component part of a poultry food, but lucerne's real excellence is found in its green state. The supply of green food is very important, as it has been found to take the place of mill offal, which has always to be purchased. Lucerne has been found to make up a considerable part of the bulk food with marked success in practice; by the analyst it has been demonstrated to be a food of very rich feed-value to stock; and its application practically has been borne out by results in poultry feeding.

In regard to lucerne and its cultivation, Mr. H. W. Potts, the Principal of the Hawkesbury Agricultural College, says:—"Increased attention is now being devoted to lucerne cultivation. The plant thrives best in a rich calcareous soil. It is practically immaterial whether the lime be found in the soil or subsoil. Lucerne seems to do well in *any soil with a porous subsoil,* which is open and so located as not to permit of water lodging either on top or in the subsoil. It is surprising how lucerne will thrive even on poor soils so long as the drainage is adequate and the soil of sufficient depth. The striking

feature of its growth is the power of the plant to be independent of rain, owing to the extraordinary facility it possesses of penetrating many feet to secure moisture. The desirable food element in lucerne is protein or albuminoids—*i.e.*, the nitrogenous compounds. It is this quality which makes lucerne so valuable for producing beef or milk, or as a portion of a horse ration; in fact, as a valuable nutritive substance it is useful for all domestic animals and poultry, and in every way rivals bran. The food constituents of bran and lucerne are for all feeding purposes equal. This explains to a great extent how the supply of lucerne practically controls the demand for bran in the open market. The protein contents of lucerne is about equal to that of bran, but the stalks of the lucerne plant only contain about one-fourth."

Green feeding is increasing amongst American poultry-men every year. An American writer says, "The duck feeder would no more think of omitting green food from a single feed than he would of shooting his ducks." In respect to the cultivation of lucerne in America for poultry-feeding, a writer in the American *Poultry Journal* says, "Alfalfa is a comparatively new forage plant in this country. It has been cultivated in Western Asia for twenty centuries, and was introduced into Greece about 470 B.C. Its botanical name is *Medicago sativa*. It is known as lucerne in England and other parts of Europe. It belongs to the same family of legumes as clover, and is admitted to be the very best fodder-plant known. It is the best hay and soiling crop in the west, and in the middle and eastern States is rapidly supplanting red clover. In Kansas and Colorado, where it is very extensively grown, it is cut three times during the season. It should be cut just before the plant begins to bloom in order to obtain the greatest amount of nutrition in the hay. If it can be procured and fed green to poultry, there is nothing to equal it, and as hay it bears the same relation to red clover as 11 to 7. Analyses vary with the time of cutting from as low as 11 per cent. to as high as 22 per cent. of protein, the higher percentage being found in cutting for the third time, and only twenty days after the previous cutting. The average analysis indicates 15·6 per cent. protein, 46·6 per cent. carbo-hydrates, and 4 per cent. fat, which is a nutritive ratio of about 1 to 3½. This illustrates its feed value, which has been found to work out in practice."

The importance of the feeding of green food to poultry-farming, although somewhat new, is of so much importance, that it is the only apology we can offer for digressing into the field of the agriculturist.

With an ordinary patch of ground growing maize and lucerne, or wheat and lucerne, duck farming can be carried on with considerable profit. In farming ducks without buildings, where winter breeding will be required, a small coop like the illustration, or a number of them, would be very useful for preventing the eggs from getting frost-bitten. With plenty of straw or hay bedding, and a few nest eggs, the ducks will frequently resort to these nests during the night, instead of laying in the open yard. Meat-feeding is very essential to

successful duck farming, and if meat can be obtained cheaply, it should be fed to them, but they can be successfully fed and reared without it, without any damaging effects.

Bullocks' livers and sheep's frys make excellent soup for mixing the mash, and also bullocks' heads and sheep's heads, which can be purchased cheaply, if the buyer can call at the abattoirs for them.

In nature, the food of the duck is both vegetable and animal. In their wild state, they live principally on marshes, where they feed on green weeds and grasses, insects and fish, and in confinement, to get the best results out of them, the combination of vegetable and animal food is equally necessary. The duck has no crop like a fowl, and the food passes directly to the gizzard. This is the reason why ducks do better on soft food. Too much grain will not give the best results, but a farmer growing his own grain can, with plenty of lucerne and crushed grain, get equally as good results as from pollard and bran feeding.

Laying Coop for Ducks.

In breeding ducklings for export, it is necessary to breed from a quick-maturing strain of Pekins, to obtain the required weight for export at ten to twelve weeks, of not less than 4½ lb. live weight. We have two classes of this duck: the ordinary-framed Pekin—pure Pekin blood, but small in frame; they are very prolific, will lay almost as well as the crack Indian Runners and Buff Orpingtons, and their eggs are very fertile. Then we have the giant-framed Pekins; they are much larger than the ordinary Pekins; they are bred by selecting the largest birds for reproduction. The eggs are not so fertile as the ordinary Pekin, but the birds attain a much larger frame, and carry more flesh right from the first or second week from hatching. Ordinary Pekin ducks will weigh at full maturity, say twelve months, 5 lb. for ducks, and 6 lb. for drakes, while the giant Pekins at twelve months will go 8 or 9 lb. for ducks, and 11 lb. for drakes. At ten to twelve weeks, the ordinary Pekin cannot be forced up to 4½ lb. live weight, or 4 lb. dressed, in quantities, whereas the giant Pekin will reach 6 lb. live weight, or 5½ lb. dressed, and at the same cost of feeding. On the 4th October, we filled up a Nonpareil incubator with fifty eggs of the

ordinary small Pekin. On the seventh day, we tested out ten infertile eggs, and on the 1st November we counted out thirty-five ducklings out of the forty fertile eggs in the machine, five having died in the shell. The thirty-five ducklings were placed in a Cypher sectional brooder, placed in the brooder-house, and they got on well from the start. They were fed on chicken mixture for the first week, and then crushed maize always before them in earthenware dishes, plenty of sand in the brooder, plenty of clean water in the fountains, and fed six times a day on bran and pollard mixed dry and crumbly, and occasionally scraps of meat from the kitchen, also green-cut lucerne daily. The Cypher sectional brooder was run at 90° Fah. for the first week, 80° Fah. for the second week, and, as the weather was warm and genial, the light was put out during the third week. After the first week, the ducklings had the run of the brooder-house, and at four weeks they were allowed out on the grass. At twelve weeks they were weighed and found to average 4¼ lb., and though we kept them for four weeks longer, they only gained about 5 lb. on the thirty ducklings, so that they should have been marketed at twelve weeks, as we kept them four weeks for practically no gain. At sixteen weeks they were sent to the export stores at Darling Harbour for export to London, but they were rejected as undersized. With every care and attention the ducklings could not be induced to put on the weight necessary for export, viz., 4½ lb. live weight, so instead of being forwarded to London they were held in cold store for use later at the College on Diploma Day, when for juicyness and fine texture they were highly commended. These ducklings cost 4d. per lb. to produce, or 1s. 2½d. each duckling. The cost was made up as follows:—

		s.	d.
20 bushels pollard at 9½d.		15	10
6 ,, bran at 8¾d.		4	4½
3 ,, cracked maize at 2s. 9d.		8	3
Chicken mixture		2	0
Feed total	£1	10	5½
50 eggs at 1s. doz.		4	2
Oil for incubator		2	6
	£1	17	1½

Or an average of 1s. 2½d. each for thirty ducklings. At the same time we raised a few giant Pekin ducklings, which at twelve weeks weighed 6 lb. each live weight.

Ducklings for the London market should be hatched out in the months of October, November, and December, they should be killed at from ten to twelve weeks, according to how the ducklings are feathering—killing should take place just before the pin feathers shoot—and despatched to London in February, March, and April, when they would arrive on the London market in March, April, and May, when ducklings well-grown will fetch good prices. These dates suit us very well to breed here, and with the right class of duck a profitable trade ought to be easily found.

(*To be continued.*)

Forestry.

Some Practical Notes on Forestry suitable for New South Wales.

[Continued from page 1112, vol. XVI.]

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XII.

Sylvicultural Conditions of New South Wales Native Trees.

No list of New South Wales trees, at all events with anything like the fullness of the present one, has yet been published. Certainly no attempt to summarise their habitats and "sylvicultural conditions" has yet been made, and this is a matter in regard to which our own people and foresters outside Australia are continually seeking information.

The following list of 521 species and varieties of trees can only be taken as approximate, for in the course of time it must be added to. Even yet New South Wales is imperfectly explored, and year by year trees are discovered which were supposed to be peculiar to the other States, and others, supposed to be but shrubs in this State, are found to attain tree size within its boundaries.

It is not always possible to define what a tree is. The old definition of a tree—a plant with a single woody stem, in contradistinction to a shrub, where several woody stems spring up from the ground, is not always literally true. Of course, with most plants it is easy enough, and the minimum size of a tree has usually been taken at about 25 feet, with a stem diameter of 9 inches. Such a minimum-sized tree may possibly produce "timber" for small articles, or at all events yield fuel or rails. In any case it is termed a "tree" in common parlance.

The differentiation of the earth's vegetation is controlled by three factors—

(*a.*) Heat (see an Isothermal Map).

(*b.*) Atmospheric precipitation (including winds). (See the Observatory Rain Map).

(*c.*) Soil. (See the Geological Map of the Geological Survey, which is very suggestive in this connection).

"Heat determines the flora, climatic humidity the vegetation; the soil as a rule merely picks out and blends the material supplied by these two climatic factors, and on its own account adds a few details."—(Schimper.)

We have various kinds of climate, which have considerable influence on the vegetation, *e.g.*—

1. The salt-laden air of the coast, often accompanied by winds.
2. The forcing steamy atmosphere of the "brushes."
3. The cold, bracing atmosphere of the table-lands.
4. The dry atmosphere of the Western plains.

Coming to the soils, we have, for example :—

1. The sandy lands of the Coast, together with the brackish swamps and tidal rivers.
2. The moist soils of river-banks and fresh-water swamps.
3. The sterile soils of the Hawkesbury sandstone, characteristically developed in the Coast Range (including Sydney and the Blue Mountains), but supporting very gardens of flowers.
4. The better soils of the Wianamatta shales. The Wianamatta shale is a mud deposit on the Hawkesbury sandstone in the counties of Cumberland and Camden—say Burwood and Homebush (near Sydney), Parramatta to Penrith, thence north in the fruit-growing districts, *e.g.*, Galston and Glenorie. Then going south, Picton and surrounding districts (including Sutton Forest).
5. The rich soils of the Brushes, often the product of decomposed volcanic rocks, but often made up of soil obtained from other sources—washed down from high levels and moistened by streams. The decomposition of basalt or "trap" yields the richest soils in the State; this is the soil and that marvellous vegetation (now rapidly disappearing for dairy farms) of the "Big Scrub," of the Richmond River, and brushes generally.
6. The granite soils, found in many places all over the State, *e.g.*, Tarana to Bathurst, Young to Harden, New England.
7. The calcareous or limestone soils, *e.g.*, Yarrangobilly to Yass, Jenolan to Wombeyan, Bungonia, Nundle, Macleay. Limestone country is, of course, cave country.
8. The black soil plains of the inner West.
9. The sandy soils of the West.

I have made the following ten divisions as convenient in practice. They are not of equal value, and some refer chiefly to soil, others to climate :—

1. Sandy coast-land and sea-side situations generally.
2. Tidal rivers and brackish swamps (saltwater).
3. River banks and swamps (freshwater).
4. Brushes.
5. Between coast and coast-range.
6. Table-lands and mountains (say 1,000-3,000 feet).
7. Alpine situations.
8. Open forest (grass-land).
9. Western slopes.
10. Dry western plains.

Obviously, as regards the localities indicated by the numbers, "averages" only have been taken, but I think they will be of value as pointers. In some cases the letters N. and S. (north and south) have been added with the view to greater precision.

Explanation of terms.

(1), (2), and (3) seem to be self-explanatory. Sea-side situations are, however, not always sandy.

(4.) A "brush" corresponds to what in India would be called jungle, and consists of well-watered, sheltered rich-soil areas in the coast districts and valleys of the coast ranges, which not only support rich arboreal vegetation, but also creepers and climbers of various kinds, and shrubby undergrowth. The tree vegetation is of a most varied kind, but rarely includes eucalypts. The soil of brushes is not always volcanic; in the county of Cumberland, for example, the Wianamatta shales often give the necessary richness of soil. In brushes the variety of trees is very great, and they are less gregarious than those of the open forest. There is a good deal of uniformity in the barks of the trees—a nearly smooth bark being of very common occurrence, while the trees are so close together that their leafy tops intertwine, and it is impossible, in many cases, to get a fair idea of the shape and general appearance of a particular tree. Only those who have visited our dense northern brush forests can form an idea of the difficulty of distinguishing more than a few kinds of trees. The massive trees, wonderfully vertical, remind one of cathedral columns; craning the neck for an upward view in the dim forest light is inconvenient and painful, and results in only general impressions, while, if a gun be fired with the view of bringing down a twig for purposes of identification, the probability is that it cannot be stated, with certainty, from what particular tree the specimen has fallen. If one cuts through a tree, it very often happens that other trees prevent its falling down, and thus its leafy top is not available for examination.

(5.) "Between coast and coast-range" is rather a vague term used to indicate trees which grow in the coastal belt from the sea-level to say 1,000 feet. Much of the country is grass-land, and also sides of hills mostly with an easterly aspect.

(6.) Table-lands and mountains (say 1,000 to 3,000 feet) will roughly include the Blue Mountains, and such districts as New England and the Southern Tableland. Many English trees flourish in this area.

(7.) "Alpine situations" is taken to indicate the coldest situations in the State, and includes not merely such mountains as Kosciusko, but anything between 3,000 or 4,000 and 6,000 feet.

(8.) "Open forest (grass-land)" is employed in a general sense.

In open forests eucalypts form the prevailing vegetation in the coast districts and also on the western slopes, and frequently attain a great size. As compared with brush forests, the soil is less rich and moist. Of the open forest timbers we may say that we possess a fair knowledge; it is mainly in regard to the brush-timbers that our knowledge is defective.

(9.) "Western slopes."—These connect the table-land with the western plains, and include the "Central Counties" of my address.* The three counties included have been defined as follows (p. 767):—

"C. 1. Wagga-Forbes-Dubbo County.

"This is another of the intermediate counties. It connects the tableland with the western plains.

* Presidential address to the Linnean Society of New South Wales, 26th March, 1902, "Botanical Survey of New South Wales: A Botanical Map."

"Its boundaries are—east, southern table-land and Liverpool Range county; north, Liverpool Plains; west, conventional lines joining Coonamble to Dubbo, Dubbo to Narrandera, and Narrandera to Corowa [a more correct boundary would be a somewhat sinuous line between Narrandera, Forbes, and Dubbo]; south, Murray River.

"C. 2. Liverpool Plains County.

"I would define it as including the counties of Darling, Nandewar, Jamison (eastern half), Baradine (eastern half), White, Pottinger, Buckland, Parry, and the western half of Inglis. Bounded on the east by New England; on the west it tapers off into the sterile sandy country, and is bounded by a conventional line from Coonamble to Bogabilla; on the south by the Liverpool Range. Mean elevation say 900 feet.

"C. 3. Macintyre-Gwydir County.

"It includes the upper waters of the Macintyre and Gwydir.

"It slopes from New England to the west, where it joins the sandy or sterile plains, being bounded by the conventional line from Coonamble to Bogabilla. It is a county corresponding in some respects (though drier) to the Upper Richmond-Clarence county on the east.'

(10.) "Dry Western Plains."

The Western plains comprise the greater portion of New South Wales, extending from north to south. There is considerable uniformity in the flora, and although attempts have been made to break down the enormous area, for our present purpose it may be looked upon as a whole. The dryness of the climate and of the soil are modified by the presence of watercourses (usually intermittent) and subterranean areas where water accumulates.

Whether a shrub or a tree will grow on a definite area depends upon the circumstance whether there is subterranean moisture to support the existence of a tree. While by keeping the soil open and supplying plant-food much can be done towards improving the western vegetation—since the roots of plants travel after water—the size of the plant that can grow at a given spot depends on the depth at which subterranean water (if any) can be reached.

The depressions (gilgais) in the west are characteristic of the presence of water.

Native Trees of New South Wales.

NOTE. The letters N and S indicate north and south of Sydney. It will be observed that, as regards the brushes (4), the vast majority of them do not come south of Sydney.

Anonaceæ—

Polyalthia nitidissima, Benth **4** (N).

Eupomatia Bennettii, F.v.M., "Native Cinnamon." **4** (N).

laurina, R. Br., "Balwarra." **4.**

Capparidaceæ—

Capparis nobilis, F.v.M. (*C. arborea*, F.v.M.), "Native Lemon." **4.**

Mitchelli, Lindl, "Native Orange." **9-10.**

Flacourtiaceæ (*Bixineæ*)—

*Scolopia Brownii, F.v.M. **4.**

Samydaceæ—

Casearia esculenta, Roxb. **4** (N).

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* The trees indicated by an asterisk have already been figured and fully described in my "Forest Flora of New South Wales" (Government Printer, Sydney), and the work is being pushed on as rapidly as the artist can finish the plates.

Pittosporaceæ—

Pittosporum rhombifolium, A. Cunn., "White Holly." **4** (N).
undulatum, Andr., "Common Pittosporum." **4.**
*phillyroides, DC., "Narrow-leaved Pittosporum." **9, 10.**
bicolor, Hook, "Bonewood." **4** (S).
Hymenosporum flavum, F.v.M., "Wollum-Wollum." **4** (N).
Bursaria spinosa, Cav., "Black-thorn" or "Box-thorn." **3, 8.**
Citriobatus lancifolius, Bail. **4** (N).

Malvaceæ—

Hibiscus heterophyllus, Vent., "Green Kurrajong." **4.**
tiliaceus, Linn. **2** (N).

Sterculiaceæ—

Sterculia quadrifida, R. Br., "Calool." **4** (N).
Brachychiton discolor, F.v.M. (*Sterculia discolor*, Benth.; *S. lurida*, Benth.), "Sycamore." **4** (N).
acerifolius, F.v.M. (*Sterculia acerifolia*, A. Cunn.), "Flame-tree." **4.**
populneus, R. Br. (*Sterculia diversifolia*, G. Don.), "Kurrajong." **6, 9, 10.**
Tarrietia argyrodendron, Benth. "Byong," "Ironwood." **4** (N).
actinophylla, Bail., "Black-Jack." **4** (N.).

Tiliaceæ—

Grewia latifolia, F.v.M. **4** (N).
Sloanea australis, F.v.M., (*Echinocarpus australis*, Benth.) "Maiden's Blush." **4.**
Woollsii, F.v.M., "Carabeen." **4.**
Elæocarpus holopetalus, F.v M., "Prickly Fig," "Blue-berry Ash" **4.**
obovatus, G. Don., "Native Ash." **4.**
reticulatus, Sm. (*E. cyaneus*, Ait.), "Small Blue-berry Ash." **4.**
longifolius, C. Moore (*E. Baeuerleni*, Maiden and Baker), "Blue-berry Ash." **4.**
eumundi, Bailey. **4** (N).
grandis, F.v.M., "Calhoun," "Coast Quandong." **4** (N).

Rutaceæ—

Phebalium Billardieri, A. Juss. (*Eriostemon squameus*, Lab.) **4.**
Bosistoa sapindiformis, F.v.M. (*Euodia pentacocca*, F.v.M.), "Union Nut." **4** (N).
euodiformis, F.v.M. **4** (N).
Melicope erythrococca, Benth. (*Euodia erythrococca*, F.v.M.) **4** (N).
australasica, Benth. (*Euodia octandra*, F.v.M.,) **4** (N).
Bouchardatia neurococca, Baill. (*Melicope neurococca*, Benth.) **4** (N).
Euodia micrococca, F.v.M. **4.**
xanthoxyloides, F.v.M. **4** (N).
*accedens, Blume. **4** (N.).
Medicosma Cunninghamii, Hook. f. (*Euodia Cunninghamii*, F.v.M.), "Glue Gum." **4** (N).
Xanthoxylum brachyacanthum, F.v.M., "Thorny Yellow-wood." **4** (N).
Geijera Muelleri, Benth., "Axe-breaker." **4** (N).
salicifolia, Schott, "Lignum Vitae." **4.**
var. angustifolia, Maiden and Betche. **6.**
parviflora, Lindl., "Wilga." **9-10.**
Pleiococca Wilcoxiana, F.v.M. **4** (N).
Pentaceras australis, Hook. f., "Scrub Hickory." **4** (N).
Acronychia Baueri, Schott, "Brush Ash." **4.**
lævis, R. and G. Forst., "White Lilly Pilly." **4.**
imperforata, F.v.M. **4** (N).
melicopoides, F.v.M. **4** (N).
acidula, F.v.M. **4** (N).
Halfordia drupifera, F.v.M., "Boogoogin." **4** (N).
scleroxyla, F.v.M. **4** (N).
Atalantia glauca, Hook. f., "Native Kumquat." **4** (N.) **9.**
Citrus australis, Planch (*C. Planchonii*, F.v.M.) "Native Lime." **4** (N).
australasica, F.v.M., "Finger Lime." **4** (N).

Simarubaceæ—

Ailanthus imberbiflora, F.v.M. **4** (N).
Cadellia pentastylis, F.v.M. **4** (N) **6.**
monostylis, Benth. **4** (N).

Meliaceæ—

Melia Azedarach, Linn, var. australasica, C. DC. (*M. composita*, Willd), "White Cedar." **4, 9.**

Dysoxylum Muelleri, Benth, "Red Bean," "Pencil Cedar." **4** (N).

Becklerianum, DC. (*D. Lessertianum*, Benth, var. *pubescens*, Benth.). **4** (N).

Lessertianum, Benth., "Rosewood." **4** (N).

rufum, Benth., "A Bastard Pencil-cedar," "A Stink-wood." **4** (N).

Amoora nitidula, Benth., "A Bog-onion." **4** (N).

Synoum glandulosum, Juss., "Bastard Rosewood." **4.**

*Owenia acidula, F.v.M., "The Gruie or Colane." **9, 10.**

cepiodora, F.v.M. **4** (N).

*Cedrela australis, F.v.M. (C. Toona. Benth.), "Red Cedar." **4.**

*Flindersia australis, R. Br., "Teak." **4** (N).

*Schottiana, F.v.M., "Cudgerie." **4** (N).

*Oxleyana, F.v.M., "Yellow Wood." **4** (N).

*Bennettiana, F.v.M., "Bogum-bogum." **4** (N).

*collina, Bail., "Stave-wood." **4** (N).

*maculosa, F. v. M. (*F. Strzeleckiana*, F. v. M.), "The Leopard Wood." **10.**

Olacaceæ—

Pennantia Cunninghamii, Miers. **4.**

Chariessa Moorei, Engler. (*Villaresia Moorei*, F. v. M.), "Soap-wood," "Native Maple." **4.**

Celastraceæ—

Celastrus dispermus, F.v.M. **4** (N).

bilocularis, F.v.M. **4** (N).

Cunninghamii, F.v.M. **4.**

Denhamia pittosporoides, F.v.M. (also var: *Dunnii*, Maiden and Betche.) (*Leucocarpum pittosporoides*, F.v.M.) **4** (N).

Elæodendron australe, Vent., "Blue Ash." **4.**

*Siphonodon australe, Benth., "Ivory Wood" **4** (N).

Rhamnaceæ—

*Ventilago viminalis, Hook., "Supple Jack." **10.**

*Alphitonia excelsa, Reiss., "Red Ash." **4.**

Emmenospermum alphitonioides, F.v.M., "Bone-wood." **4** (N).

Pomaderris apetala, Lab., "Hazel." **3.**

cinerea, Benth. **3.**

Sapindaceæ—

Atalaya multiflora, Benth. **4** (N).

*hemiglauca, F.v.M., "Western Whitewood." **10.**

Diploglottis Cunninghamii, Hook. f. (*D. australis*, Radlk.), "Native Tamarind." **4.**

Castanospora Alphandi, F.v.M. (*Nephelium Callarie*, Bail.) **4** (N.)

Cupania Wadsworthii, F.v.M. (*Harpullia Wadsworthii*, F.v.M.) **4** (N).

*anacardioides, "A. Rich. (*Cupaniopsis anacardioides*, Radlk.), A Cupania" **1, 2.**

serrata, F.v.M. (*Cupaniopsis serrata*, Radlk.), "Gulwin-Gulwin." **4** (N)

punctulata, F.v.M. (*Cupaniopsis punctulata*, Radlk.) **4** (N).

pseudorhus, A. Rich. (*Jagera pseudorhus*, Radlk.), "Iccaaya." **4** (N).

xylocarpa, A. Cunn. (*Elattostachys xylocarpa*, Radlk.), "Wootarie." **4** (N).

var. nervosa, F.v.M. (*C. nervosa*, F.v.M.) **4** (N).

pyriformis, F.v.M. (*Ratonia pyriformis*. Benth.) **4** (N).

anodonta, F.v.M. (*Ratonia anodonta*, Benth.) **4** (N).

stipitata, F.v.M. (*Ratonia stipitata*, Benth.) **4** (N).

tenax, A. Cunn. (*Ratonia tenax*, Benth.) **4** (N).

Nephelium semiglaucum, F.v.M. (*Cupania semiglauca*, F.v.M.) "Wild Quince." **4.**

connatum, F.v.M. (*Alectryon connatus*, Radlk.) **4** (N).

subdentatum, F.v.M. (*Alectryon subdentatus*, Radlk.) **4** (N).

Forsythii, Maiden and Betche, (*Alectryon Forsythii*, Radlk.). **6.**

tomentosum, F.v.M. (*Alectryon tomentosus*, Radlk.) **4** (N).

coriaceum, Benth. (*Alectryon coriaceus*, Radlk.) **4** (N).

leiocarpum, F.v.M. (*Alectryon subcinereus*, Radlk.) **4.**

foveolatum, F.v.M. (*Arytera foveolata*, Radlk.) **4** (N).

divaricatum, F.v.M. (*Arytera divaricata*, Radlk.), [Syn. *N. Beckleri*, Benth.] "Coogera." **4** (N).

distyle, F.v.M. (*Ratonia distylis*, F.v.M.) **4** (N).

Sapindaceæ—*continued.*

*Heterodendron oleæfolium, Desf., "Western Rosewood." **9, 10.**
diversifolium, F.v.M. **4** (N).
Harpullia alata, F.v.M. **4** (N).
Hillii, F.v.M. **4** (N).
pendula, Planch. **4** (N).
Akania Hillii, Hook. f. **4** (N).

Anacardiaceæ—

*Rhodosphæra rhodanthema, Engler (*Rhus rhodanthema*, F.v.M.), "A Yellow-wood." **4** (N).
Euroschinus falcatus, Hook. f. **4** (N).

Leguminosæ—

Jacksonia scoparia, R.Br., "Dog-wood." **5, 6, 8.**
Daviesia corymbosa, Sm. var. arborea, Maiden (*D. arborea*, F.v.M. et Scortech.) **6.**
Erythrina vespertilio, Benth., "Bats'-wing Coral." **4** (N).
*Castanospermum australe, A. Cunn., "Black Bean." **4** (N).
*Barklya syringifolia, F.v.M. **4** (N).
Cassia Brewsteri, F.v.M. **4** (N).
Bauhinia Carronii. F.v.M. **4** (N).
Acacia sentis, F.v.M., "Thorny Wattle." **10.**
penninervis, Sieb., "Mountain Hickory." **6, 7.**
neriifolia, A. Cunn. **6.**
pycnantha, Benth., "Broad-leaved Wattle." **9, 10.**
notabilis, F.v.M. **9, 10.**
hakeoides, A. Cunn., "Western Black Wattle." **9, 10.**
salicina, Lindl., "Kooba." **9, 10.**
leptopetala, Benth. **10.**
lunata, Sieb. **5.**
podalyriæfolia, A. Cunn., "Broad-leaved Silver Wattle.").
subporosa, F.v.M., "River Wattle." **3, 5, 6** (S).
homalophylla, A. Cunn., "Yarran." **9, 10.**
Cambagei, R. T. Baker, "Gidgee," or "Stinking Wattle." **9, 10.**
*pendula, A. Cunn., "Weeping Myall." **9, 10.**
Oswaldi, F.v.M., "Miljee." **9, 10.**
coriacea, DC.. **10.**
stenophylla, A. Cunn., "Munmmula." **9, 10.**
*melanoxylon, R.Br., "Blackwood." **5, 6, 7, 8.**
implexa, Benth., Hickory." **5, 6, 8.**
harpophylla, F.v.M., "Brigalow." **9, 10.**
excelsa, Benth., "Ironwood." **9, 10.**
binervata, DC., "Two-veined Hickory." **4, 5, 6.**
Bakeri, Maiden. **4** (N).
longifolia, Willd., "Golden Wattle." **1, 3, 5.**
cyperophylla, F.v.M. **9, 10.**
aneura, F.v.M., "Mulga." **10.**
doratoxylon, A. Cunn., "Currawang." **9, 10.**
glaucescens, Willd., "Coast Myall." **3, 5, 6.**
Maideni, F.v.M., "Broad-leaved Sally." **4, 5, 6.**
Cunninghamii, Hook., "Bastard Myall" or "Kurracabah." **5, 6, 8, 9.**
aulacocarpa, A. Cunn., "Brush Ironbark." **4.**
elata, A. Cunn., "Pepper-tree Wattle" or "Cedar Wattle." **3, 4, 5, 6.**
pruinosa, A. Cunn., "Mealy-stemmed Wattle." **4, 5.**
Baileyana, F.v.M., "Cootamundra Wattle," **6.**
Muelleriana, Maiden and Baker. **3.**
decurrens, Willd., "Black or Green Wattle." **5, 6, 8.**
dealbata, Link., "Silver Wattle." **5, 6, 8.**
pubescens, R.Br. **5.**
*Albizzia pruinosa, F.v.M. (*Pithecolobium pruinosum*, Benth.), "A Stink-wood." "Marble-wood." **4.**
Tozeri, F.v.M. (*Pithecolobium grandiflorum*, Benth.) **4** (N).
Hendersoni, F.v.M., "Nuggum-nuggum." **4** (N).
Muelleriana, Maiden and Baker. **4** (N).

Saxifrageæ—

Argophyllum Lejourdani, F.v.M. 4 (N).
nullumense, R. T. Baker. 4 (N).
Abrophyllum ornans, Hook. f. 4.
Cuttsia viburnea, F.v.M. 4. (N).
Quintinia Sieberi, DC., " Opossum Wood." 4, 5.
Verdonii, F.v.M. 4 (N).
Polyosma Cunninghamii, J. J. Benn., " Feather Wood." 4.
Anopterus Macleayanus, F.v.M. 4 (N).
Callicoma serratifolia, Andr., " Black Wattle " (of the earliest settlers); " Tdjer-ruing." 3, 4, 5.
Ceratopetalum gummiferum, Sm., " Christmas Tree." 4.
*apetalum, D. Don, " Coach Wood." 4.
Schizomeria ovata, D. Don., " Crab Apple," " White Cherry." 4, 6.
Ackama Muelleri, Benth. (*Weinmannia paniculosa*, F.v.M.), " Corkwood." 4.
Weinmannia lachnocarpa, F.v.M., " Marrara," " Brush Redwood." 4 (N).
rubifolia, Benth., " A Marrara." 4 (N).
Geissois Benthami, F.v.M. (*Weinmannia Benthami*), " A Marrara." 4 (N).
Davidsonia pruriens, F.v.M., var. Jerseyana, F.v.M. and Maiden. " Davidson's Plum" 4 (N).

Rosaceæ—

Eucryphia Moorei, F.v.M. 3, 4, 6.

Rhizophoreæ—

Rhizophora mucronata, Lam., " A Mangrove." 2 (N).

Myrtaceæ—

Leptospermum lævigatum, F.v.M. 1.
Callistemon coccineus F.v.M, " Red Bottle Brush." 3.
salignus, DC., " White Bottle Brush." 3.
Melaleuca pauciflora, Turcz. 3, 4.
linariifolia, Sm., " Narrow-leaved Tea-tree." 3, 5.
*Leucadendron, Linn., " Broad-leaved Tea-tree." 1, 2.
genistifolia, Sm. 3, 5.
styphelioides, Sm., " Prickly Tea-tree." 3, 5.
Angophora subvelutina, F.v.M., " Rough-barked Apple (Broad-leaved)." 3, 5, 8.
intermedia, DC., " Rough-barked Apple (Narrow-leaved)." 3, 5, 8.
var. melanoxylon (A. *melanoxylon*, R. T. Baker). 10.
*lanceolata, Cav., " Smooth-barked Apple." 5, 6, 9.
*†Eucalyptus stellulata, Sieb., " Black Sally." 6, 7, 8.
*coriacea, A. Cunn., (*E. pauciflora*, Sieb.) " White or Cabbage Gum." 6, 7, 8.
var. alpina, " Snow Gum." 7.
vitrea, R. T. Baker, " A Messmate." 6, 8.
*dives, Schauer, " Broad-leaved Peppermint." 6, 9.
Andrewsi, Maiden, " New England Peppermint." 6.
*regnans, F.v.M., " Giant Peppermint." 6.
*amygdalina, Labill., " A Peppermint," " Narrow-leaved Peppermint." 6.
*numerosa, Maiden, " River White Gum." 3, 6.
virgata, Sieb. (the large form). 5, 6.
var. fraxinoides, Maiden (*E. fraxinoides*, Deane and Maiden). 6.
var. altior, Deane and Maiden (*E. oreades*, R. T. Baker) " Mountain Ash." 6.
Planchoniana, F.v.M. 1.
Sieberiana, F.v.M., " Mountain Ash." 5, 6.
hæmastoma, Sm., " White or Scribbly Gum " (also var. *micrantha*). 1, 5, 6.
pilularis, Sm., " Blackbutt." 1, 5.
Muelleriana, Howitt, " Yellow Stringybark." 1, 5, 6.
eugenioides, Sieb., " Stringybark." 1, 5, 6.
capitellata, Sm., " Stringybark." 1, 5, 6.
macrorrhyncha, F.v.M., " Red Stringybark." 6.

† This list of Eucalypts is not a complete list of all the New South Wales species, but only of those which attain tree size. The genus is under revision, and it is probable that species may be added to the present list.

Myrtaceæ—*continued.*

*†Eucalyptus obliqua, L'Herit., "Messmate." **6.**

var. alpina, Maiden (*E. delegatensis*, R. T. Baker), "Mountain Ash." **7.**

piperita, Sm., "Peppermint." **1, 5, 6.**

Consideniana, Maiden. **1, 5, 6.**

acmenioides, Schauer, "White Mahogany," **1, 5.**

umbra, R. T. Baker, "White Mahogany." **1, 5.**

microcorys, F.v.M., "Tallow-wood." **4, 5.**

microtheca, F.v.M., "Coolabah," **9, 10.**

polyanthemos, Schauer, "Red Box or Slaty Gum." **6, 9.**

Rudderi, Maiden, "Coast Red Box." **1, 5.**

bicolor, A. Cunn., (*E. largiflorens*, F.v.M.) "Black or Flooded Box." **9, 10.**

odorata, Behr., "South Australian Peppermint." **9, 10.**

cajuputea, F.v.M. **10.**

acacioides, A. Cunn. **9, 10.**

fasciculosa, F.v.M., "Western Red Box." **9, 10.**

*paniculata, Sm., "White or Grey Ironbark." **5, 6.**

crebra, F.v.M., "Narrow-leaved Red Ironbark." **5, 6, 9.**

melanophloia, F.v.M., "Silver-leaved Ironbark." **6, 9.**

Boormani, Deane and Maiden, "Black Box." **5.**

siderophloia, Benth., "Broad-leaved Red Ironbark." **5.**

var. glauca, Deane and Maiden, "Blue-leaved Ironbark." **9.**

*sideroxylon, A Cunn., "The Mugga: A Red Ironbark." **6, 9.**

Caleyi, Maiden, "Red Ironbark." **6, 9.**

affinis, Deane and Maiden. **9.**

*hemiphloia, F.v.M., "Grey Box." **5.**

var. albens, F.v.M., "White Box." **9.**

var. microcarpa, Maiden, "Small-fruited Box." **9.**

Woollsiana, R. T. Baker, "Narrow-leaved Box." **9, 10.**

*melliodora, A. Cunn., "Yellow Box." **7, 9.**

Bosistoana, F.v.M., "South Coast Red Box." **5, 6.**

Baueriana, Schauer, "Blue Box." **6.**

var. conica, Maiden (*E. conica*, Deane and Maiden), "Fuzzy Box." **9.**

populifolia, Hook., "Bimbil Box." **9, 10.**

Behriana, F.v.M., "Mallee." **9.**

ochrophloia, F.v.M., "Napunyah." **10.**

oleosa, F.v.M., "Red Mallee." **10.**

Cambagei, Deane and Maiden, "Bundy." **6, 9.**

*goniocalyx, F.v.M., "Mountain Gum." **4, 6.**

globulus, Labill., "Tasmanian Blue Gum." **6, 7.**

Maideni, F.v.M., "Southern Blue Gum." **5, 6.**

*longifolia, Link and Otto, "Woolly-butt." **5.**

robusta, Sm., "Swamp Mahogany." **1.**

*saligna, Sm., "Coast Blue Gum" or "Flooded Gum." **3, 4, 5.**

var. botryoides, Maiden, (*E. botryoides*, Sm.) "Bangalay." **1.**

Deanei, Maiden, "Broad-leaved Blue Gum." **6.**

Dunnii, Maiden, "Macpherson Range White Gum." **4.**

Stuartiana, F.v.M., "Apple," "White Peppermint." **6.**

var. parviflora, Deane and Maiden (*E. angophoroides*, R. T. Baker). **6.**

Banksii, Maiden, "Tenterfield Woolly-butt." **6.**

quadrangulata, Deane and Maiden, "A Box." **6.**

pulverulenta, Sims, "Argyle Apple." **5, 6.**

nova-anglica, Deane and Maiden, "Black Peppermint." **6.**

acaciæformis, Deane and Maiden, "Grey Peppermint." **6.**

Macarthuri, Deane and Maiden, "Camden Wolly-butt." **3, 6.**

aggregata, Deane and Maiden, "Black or Flooded Gum." **3, 6.**

Gunnii, Hook. f., "Cider Gum." **7.**

var. acervula, Deane and Maiden, "Yellow Gum." **3, 6.**

var. ovata, Deane and Maiden, "Swamp Gum." **3, 6.**

var. rubida, Maiden, "Candle-bark." **6.**

var. maculosa, Maiden, "Mountain Spotted Gum." **6.**

Myrtaceæ—*continued.*

*†Eucalyptus scoparia, Maiden, "Wallangarra White Gum." **6.**
viminalis, Labill., "Ribbony Gum." **3, 6.**
Smithii, R. T. Baker, "White Top." **6.**
tesselaris, F.v.M., "Carbeen." **9.**
*resinifera, Sm., "Red Mahogany." **5, 6.**
var. grandiflora, Benth. **5.**
*punctata, DC., "A Grey Gum." **5, 6.**
var. grandiflora, Deane and Maiden. **5.**
propinqua, Deane and Maiden, "Small-fruited Grey Gum." **5, 6.**
Kirtoniana, F.v.M. (*E. patentinervis*, R. T. Baker), "A Mahogany." **1.**
rostrata, Schlecht., "River Red Gum." **3, 9, 10.**
Seeana, Maiden, "Stone Gum." **5.**
Morrisii, R. T. Baker (? *E. exserta*, F.v.M.) **9.**
*tereticornis, Sm., "The Forest Red Gum." **5.**
var. dealbata, Deane and Maiden, "Inland Red Gum." **6, 9.**
squamosa, Deane and Maiden, "Scaly-barked Red Gum." **5, 6.**
amplifolia, Naudin, "Swamp Red Gum." **3, 6.**
Bancrofti, Maiden, "Orange Gum." **5, 6.**
Baileyana, F.v.M. **6.**
*corymbosa, Sm., "The Bloodwood." **5, 6.**
terminalis, F.v.M. (? *E. intermedia*, R. T. Baker), "Pale Bloodwood." **5, 9, 10.**
trachyphloia, F.v.M., "White Bloodwood." **9.**
eximia, Schauer, "Yellow Bloodwood." **5, 6.**
*maculata, Hook., "Spotted Gum." **5, 6.**
Tristania neriifolia, R.Br., "Narrow-leaved Water Gum." **3, 4.**
suaveolens, Sm., "Swamp Mahogany." **4, 8.**
*conferta, R.Br., "Brush Box." **3, 4** (N).
laurina, R.Br., "Water Gum." **3, 4.**
*Metrosideros glomulifera, Sm. (*Syncarpia laurifolia*, Ten.), "Turpentine Tree." **4, 5, 6, 8.**
leptopetala, F.v.M. (*Syncarpia leptopetala*, F.v.M.), "Brush Turpentine." **4** (N).
Backhousia myrtifolia, Hook. and Harv., "Grey Myrtle." **3, 4, 5.**
sciadophora, F.v.M. **3, 4** (N).
Rhodomyrtus psidioides, Benth. **3, 4** (N).
Myrtus rhytisperma, F.v.M. **4** (N).
acmenioides, F.v.M. **4** (N).
Rhodamnia trinervia, Blume, "Three-veined Myrtle." **4** (N).
var. glabra, Maiden and Betche. **4** (N).
argentea, Benth., "Silver Myrtle." **4.**
Decaspermum paniculatum, Baill. (*Nelitris paniculata*, Lindl.) **3, 4** (N).
Eugenia Smithii, Poir., "Lilly Pilly." **3, 4, 5.**
var. minor, Maiden. **4** (N).
hemilampra, F.v.M. **3, 4** (N), **5.**
Ventenatii, Benth., "Drooping Myrtle." **3, 4** (N), **5.**
Moorei, F.v.M. **3, 4** (N), **5.**
corynantha, F.v.M. **3, 4** (N), **5.**
Luehmanni, F.v.M. (*E. parvifolia*, C. Moore), "Small-leaved Myrtle." **3, 4** (N), **5.**
Hodgkinsoniæ, F.v.M. **3, 4** (N), **5.**
brachyandra, Maiden and Betche (*Memecylon australe*, C. Moore). **3, 4,** (N), **5.**
paniculata, Banks and Sol. (*E. australis*, Wendl.; *E. myrtifolia*, Sims), "Brush Cherry." **3, 4, 5.**
cyanocarpa, F.v.M., "Blue Myrtle." **3, 4, 5.**

Araliaceæ—

Panax Murrayi, F.v.M. (*Polyscias Murrayi*, Harms.), "Pencil Cedar." **3, 4.**
*elegans, C. Moore and F.v.M., "Black Pencil Cedar." **3, 4.**

Cornaceæ—

Marlea vitiensis, Benth. (*Stylidium vitiense*, F.v.M.), "Northern Musk-tree." **4** (N).

Rubiaceæ—

Ixora Beckleri, Benth. **4** (N).
Hodgkinsonia ovatiflora, F.v.M. **3, 4** (N).
Canthium latifolium, F.v.M., "Wild Lemon." **9, 10.**
lucidum, Hook. and Arnott. **4** (N).
oleifolium, Hook., "Wild Lemon." **9, 10.**
buxifolium, Benth. **4** (N).
vacciniifolium, F.v.M. **4.**
coprosmoides, F.v.M. **4** (N).
Psychotria loniceroides, Sieb. **4.**

Compositæ—

Olearia argophylla, F.v.M., "Musk-tree." **4** (S), **6.**
Bedfordia salicina, DC. (*Senecio Bedfordii*, F.v.M.). **4** (S), **6.**

Epacrideæ—

Monotoca elliptica, R.Br. (*Styphelia elliptica*, Sm.). "Wallang-unda." **1, 5.**
Trochocarpa laurina, R.Br., "Birranduna." **4, 6.**

Myrsinaceæ—

Rapanea subsessilis, Mez. (*Myrsine subsessilis*, F.v.M.). **4**
Howittiana, Mez. (*Myrsine Howittiana*, F.v.M.). **4.**
variabilis, Mez. (*Myrsine variabilis*, R. Br.). **4.**
Aegiceras majus, Gærtn (*A. corniculatum*, Blanco). **1, 2.**

Sapotaceæ—

Niemeyera prunifera, F.v.M. (*Chrysophyllum pruniferum*, F.v.M.). **4** (N).
Amorphospermum antilogum, F.v.M. **4** (N).
Sideroxylon Richardi, F.v.M. (*Achras laurifolia*, F.v.M.). **4.**
*australe, Benth. et Hook. f. (*Achras australis*, R. Br.)," Black Apple." **4.**
myrsinoides, Benth. et Hook. f. (*Achras myrsinoides*, A. Cunn.) **4** (N).
Hormogyne cotinifolia, DC. **4** (N).

Ebenaceæ—

Diospyros mabacea, F.v.M. (*Cargillia mabacea*, F.v.M.) **4** (N).
Cargillia, F.v.M. (*Cargillia australis*, R. Br.), "Boorcerra," "Black Plum." **4.**
pentamera, F.v.M. (*Cargillia pentamera*, F.v.M.), "Caarambool," "Gray Plum." **4.**
Maba fasciculosa, F.v.M. **4.**
sericocarpa, F.v.M. **4.**

Styraceæ—

Symplocos spicata, Roxb., var. australis, Benth. (*S. Stawellii*, F.v.M.) **4** (N).
Thwaitesii, F.v.M. **4** (N).

Jasminaceæ—

Olea paniculata, R.Br., "Marble-wood." **4** (N).
Notelæa ovata, R.Br., "Dunga-runga," "Native Olive." **5.**
longifolia, Vent., "Coobagum," "Native Olive." **5, 6.**
microcarpa, R.Br. **5, 6.**
ligustrina, Vent., "Ironwood," "Silkwood." **5.**

Apocynaceæ—

Ochrosia Moorei, F.v.M. **4** (N).
Tabernæmontana orientalis, R.Br., var. angustisepala, Benth., "Bitter-bark." **4** (N).
*Alstonia constricta, F.v.M., "A Bitter Bark." **4** (N), **9, 10.**

Loganiaceæ—

Strychnos psilosperma, F.v.M. **4** (N).

Boraginaceæ—

Ehretia acuminata, R.Br., "Brown Cedar." **4.**
membranifolia, R.Br. **4** (N), **9.**

Solanaceæ—

Duboisia myoporoides, R.Br., "Cork-wood." **4.**

Myoporaceæ—

Myoporum tenuifolium, Forst: (*M. acuminatum* R.Br.). **1, 5.**
serratum, R.Br. (M. insulare, R.Br), "Blue-berry Tree." **1 (S).**
deserti, A. Cunn. **9, 10.**
platycarpum, R.Br., "Sugar-tree," "Dogwood," **9, 10.**
Eremophila oppositifolia, R.Br. **10.**
Mitchelli, Benth., "Buddtha," "Budda," "Sandalwood." **10.**
bignoniflora, F.v.M. **10.**
latifolia, F.v.M. **10.**

Verbenaceæ—

Clerodendron tomentosum, R.Br. **4.**
*Gmelina Leichhardtii, F.v.M., "Beech," "White Beech." **4** (N).
Vitex trifolia, Linn. **1.**
lignum-vitæ, A. Cunn., "Lignum-vitæ," "Black Satin-wood." **1, 4 (N).**
glabrata, R.Br. **1.**
Avicennia officinalis, Linn., "White Mangrove." **1, 2.**

Labiatæ—

Prostanthera lasianthos, Labill., "Mint-tree." **3, 4, 6.**

Phytolaccaceæ—

Codonocarpus australis, A. Cunn., "Coastal Horse-radish Tree." **4** (N).
cotinifolius, F.v.M., "Western Horse-radish Tree." **9, 10.**

Nyctaginaceæ—

Pisonia Brunoniana, Endl., "Bird-lime." **4.**

Monimiaceæ—

Hedycarya angustifolia, A. Cunn. (*H. Cunninghamii*, Tul.), "Wild Mulberry." **4.**
Tetrasynandra pubescens, Perk. (*Kibara pubescens*, Benth.) **4** (N).
longipes, Perk. (*Kibara longipes*, Benth.) **4** (N).
Wilkiea macrophylla, A. DC. (*Kibara macrophylla*, Benth.) **4.**
Daphnandra micrantha, Benth., "Yellow-wood." **4** (N).
tenuipes, Perk. **4** (N).
Atherosperma moschatum, Labill., "Victorian Sassafras." **4** (S).
*Doryphora sassafras, Endl., "N.S.W. Sassafras." **4.**

Lauraceæ—

Cryptocarya patentinervis, F.v.M. **4** (N).
*obovata, R.Br., "She-Beech," "Sycamore." **4** (N).
glaucescens, R.Br., "Black Pine," "Brown Beech." **4.**
microneura, Meissn. (*C. glaucescens*, R.Br., var. *microneura*, Meissn.) **4.**
triplinervis, R.Br. **4** (N).
Meissneri, F.v.M. **4** (N).
australis, Benth., "Grey Sassafras." **4** (N).
Beilschmiedia obtusifolia, Benth. (*Nesodaphne obtusifolia*, Benth.) **4** (N).
Endiandra discolor, Benth., "Murrogun." **4** (N).
Sieberi, Nees, "Cork-wood." **4.**
globosa, Maiden and Betche. **4** (N).
virens, F.v.M. **4** (N).
Muelleri, Meissn. **4** (N).
pubens, Meissn. **4** (N).
var. glabriflora, Benth. **4** (N).
Cinnamomum Oliveri, Bail., "Queensland Sassafras." **4** (N).
virens, R. T. Baker. **4** (N).
Litsea dealbata, Nees. **4.**
var. rufa, Benth. **4** (N).
Litsea hexanthus, Juss. (*Tetranthera ferruginea*, R.Br.), "Ugaulbie." **4** (N).
reticulata, Benth. (*Tetranthera reticulata*, Meissn.), "Bolly Gum." **4** (N).

Proteaceæ—

Persoonia salicina, Pers. **5, 6.**
lucida, R.Br. **5, 6.**
mollis, R.Br. **5, 6.**
Helicia glabriflora, F.v.M. **4** (N).
ferruginea, F.v.M. **4.**
Youngiana, F.v.M. **4** (N).

Proteaceæ—*continued.*

*Macadamia ternifolia, F.v.M., "Queensland Nut." **4** (N).
prealta, Bail. (*Helicia prealta*, F.v.M.), "Possum Nut." **4** (N).
Hicksbeachia pinnatifida, F.v.M. **4** (N).
Xylomelum pyriforme, Sm., "Native Pear." **5, 6.**
Orites excelsa, R.Br., "Prickly Ash," "Silky Oak." **4** (N).
*Grevillea robusta, A. Cunn., "Silky Oak." **4** (N).
striata, R.Br., "Beef-wood." **9, 10.**
Hilliana, F.v.M., "Silky Oak," "White Yiel Yiel." **4** (N).
Hakea lorea, R.Br., "A Western Cork-tree." **10.**
saligna, R.Br. **5, 6.**
leucoptera, R.Br., "Needle-wood." **9, 10.**
Stenocarpus sinuatus, Endl., "Fire-tree." **4** (N).
*salignus, R.Br., "A Beef-wood." **4.**
Banksia ericifolia, Linn., "Small-leaved Honeysuckle." **5, 6.**
spinulosa, Sm. **5, 6.**
marginata, Cav., "Honeysuckle." **5, 6, 8.**
*integrifolia, Linn., "White Honeysuckle." **1, 5.**
serrata, Linn., "Red Honeysuckle." **1, 5, 6.**

Euphorbiaceæ—

Actephila grandifolia, Baill. **4** (N).
Mooreana, Baill. **4** (N).
Petalostigma quadriloculare, F.v.M., and var. glabrescens, "Wild Quince," **Benth.** **4** (N).
Phyllanthus Ferdinandi, Muell. Arg. **1, 2.**
var. minor, Benth. **4** (N).
supra-axillaris, F.v.M. **4** (N).
Hemicyclia australasica, Muell. Arg. **4** (N).
Bridelia exaltata, F.v.M., "Brush Ironbark." **4** (N).
Cleistanthus Cunninghamii, Muell. Arg. **4.**
Croton insularis, Baill., "Native Cascarilla," "Warrel." **4.**
phebalioides, F.v.M., "Native Cascarilla." **4.**
Verreauxii, Baill., "Native Cascarilla." **4.**
acronychioides, F.v.M. **4** (N).
affinis, Maiden and Baker. **4** (N).
Claoxylon australe, Baill. **4.**
var. laxiflora, Benth.
var. dentata, Benth.
Mallotus claoxyloides, Muell. Arg. **4** (N).
philippinensis, Muell. Arg., "Kamala" (of India). **4** (N).
discolor, F.v.M., "Bungaby." **4** (N).
Macaranga tanaria, Muell. Arg., "Tumkullum." **4** (N).
*Baloghia lucida, Endl., "Brush Bloodwood." **4.**
Homalanthus Leschenaultianus, Juss. (*Omalanthus populifolius*, Grah.; *Carumbium populifolium*, Reinw.), "Native Poplar," "Bleeding-heart Tree." **4.**
stillingiifolius, F.v.M. (*Carumbium stillingiæfolium*, Baill.) **4** (N).
Excæcaria agallocha, Linn., "Milky Mangrove." **2, 4** (N).
Dallachyana, Baill. **4** (N).

Urticaceæ—

Celtis paniculata, Planch. **4** (N).
Trema canabina, Lour., var. aspera, F.v.M. (*T. aspera*, Blume). **4.**
var. orientalis, F.v.M. (*T. orientalis*, Blume). **4** (N).
*Aphananthe philippinensis, Planch., "Native Elm." **4.**
Ficus Cunninghamii, Miq. **4** (N).
*Henneana, Miq., "Cedar Fig," "A Deciduous Fig." **1, 4.**
eugenioides, F.v.M. **1, 4.**
Muelleri, Miq. **4.**
*rubiginosa, Desf., "Rusty Fig." **1, 3, 4.**
platypoda, A. Cunn. **1** (N).
macrophylla, Desf., "Moreton Bay Fig." **4** (N).
Bellingeri, C. Moore, "Bellinger Fig." **4** (N).
stenocarpa, F.v.M. **4** (N).
scabra, G. Forst. (*F. aspera*, Forst.), "Rough-leaved Fig." **4.**
var. subglabra, Benth. **4.**
opposita, Miq. **4** (N).

Urticaceæ—*continued.*

Pseudomorus Brunoniana, Bureau, " Lagaulbie," " Whalebone Tree." **4.**
Laportea gigas, Wedd., " Giant Nettle." **4.**
photiniphylla, Wedd., " Small-leaved Nettle." **4** (N).
moroides, Wedd. **4** (N).

Casuarinaceæ—

*Casuarina stricta, Ait. (*C. quadrivalvis*, Labill), " Drooping She-Oak." **1, 9, 10**
*lepidophloia, F.v.M. (*C. Cambagei*, R. T. Baker), " Belah." **9, 10.**
*Luehmanni, R. T. Baker, " Bull Oak." **8, 9.**
*glauca, Sieb., " Swamp Oak." **2.**
*suberosa, Otto. and Dietr., " Black She-oak." **5, 6.**
*Cunninghamiana, Miq., " River Oak." **3.**
*inophloia, F.v.M. and Bailey, " Thready-barked Oak." **6** (N).
*torulosa, Ait., " Forest Oak." **5, 6.**

Cupuliferæ—

Fagus Moorei, F.v.M., " Negro-head Beech." **6** (N).

Santalaceæ—

*Fusanus acuminatus, R.Br. (*Santalum acuminatum*, A. DC.), " Quandong." **9, 10.**
persicarius, F.v.M. (*Santalum persicarium*, F.v.M.) **9, 10.**
Exocarpus latifolia, R.Br., " Broad-leaved Cherry." **4** (N).
cupressiformis, Labill., " Native Cherry." **5, 6.**

Coniferæ—

*Callitris Macleayana, F.v.M., " Stringybark Pine," " Port Macquarie Pine." **4** (N), **5.**
*verrucosa, R.Br., " Mallee Pine." **9, 10.**
*robusta, R.Br., " White or Common Pine." **9, 10.**
*columellaris, F.v.M. **1** (N).
*Muelleri, Benth. and Hook. f., " Cypress Pine." **6.**
*propinqua, R.Br. **9.**
*calcarata, R.Br., " Black Pine." **9, 10.**
*cupressiformis, Vent., " Port Jackson Pine." **5.**
Araucaria Cunninghamii, Ait., " Richmond River or Hoop Pine." **4** (N).
*Podocarpus elata, R.Br., " Brown Pine." " She Pine." **3, 4.**

Palmaceæ—

Archontophoenix Cunninghamiana, Wendl. (Ptychosperma Cunninghamii, Wendl.).
" Bangalow Palm." **4.**
Livistona australis, Mart., " Cabbage Palm." **4.**

Pandanaceæ—

Pandanus pedunculatus, R.Br., " Screw Pine." **1** (N).

Lecture on Dairying.

Mr. O'Callaghan at Tamworth.

Mr. M. A. O'Callaghan, Government Dairy Expert, delivered a lecture on dairying in the Oddfellows' Hall in the afternoon. Mr. W. M. Wilson, President of the Tamworth Agricultural Association, occupied the chair, and there were about forty persons present, the great majority being dairy farmers.

Mr. O'Callaghan said that in a district where dairying was a new industry, he was often asked whether it was likely to be overdone. Well, a few figures would give an idea of the magnitude of the industry, and they might be surprised to hear that the output of wheat had to take secondary place to the production of milk throughout the world. In 1903 the value of wheat produced throughout the world was £520,000,000, while the value of milk was about £5,000,000 more. The figures for Asia in regard to milk are not included, as they are not reliable; but at any rate the sum mentioned did not take into account the value of the annual calf produced by each cow. In 1864, England imported dairy products to the value of £7,000,000 sterling. Forty years later, namely, in 1904, their value was £31,000,000. That amount was paid away by Great Britain to foreigners for the most part, of which £21,000,000 was for butter. In 1896 this State sent £100,000 worth of butter to England; last year we sent about £800,000—an increase of seven-fold. Denmark, with its small area, exported £9,000,000 worth of butter.

Our Opportunity.

How is it that there is room for new countries, such as Australia, Siberia, Canada, and the Argentine to come into the dairy produce market? This could be attributed to several things. There was the great increase of consumption, for instance, which is caused by the increased wealth of the people and the increased population, by the decrease in retail price of butter, the improved butter which was put upon the market, better trading facilities, greater knowledge among the people of the food value of butter, and the better control of such products as margarine. An interesting feature of the position was that thickly populated countries which were once exporters are now importing from the new countries. Ten years ago Germany was a large exporter of butter; now, her manufactories having largely increased, she is an importer instead. The manufactures attracted population to the cities, thus making labour in the country dearer, which choked out the dairying industry. It was the same with other countries, and this was going to be the history of the United States too, which country will probably take much of Canada's

surplus. Scientific investigation had made the dairying industry possible in this country; thus we could send butter long distances to a market. He thought he had answered the question as to whether the industry was likely to be overdone. He thought it was most improbable, more especially with countries south of the equator, whose summer corresponds with the European winter—the time when the price is high. We are on velvet in Australia in that regard, and because our cost of production was so much less.

How to Commence.

If he knew the district more intimately, he could go into greater details as to the chief rules for successfully commencing the industry. The first consideration was undoubtedly the rainfall. No matter how rich the land might be, a good rainfall is essential. The lowest under any circumstances must not be less than 25 inches: with 30 inches which we had here, a man had to use his brains to make a success; with 50 inches he should be successful without any difficulty. Cows must have a plentiful supply of good water, a running stream if possible—certain good clean water that the animal would taste with pleasure in consuming. On a hot day a cow will take 8 or 10 gallons of water, as her product contained the greatest percentage of water, and she wanted much for her bodily needs. Dams, if used, must be protected from filth, which otherwise the cows convey on their skins and deposit in the milk-pail. Then provision must be made for green fodder, or at any rate a good substitute. In winter time the farmer should have ensilage if he wants to make the most of his industry. No matter how good his hay might be, and lucerne hay was very good, there must be some succulent food. Fodder could be stored in silos in its green state, either by tub, or stack, or pit.

About the Herd.

To come to the class of cow. In buying a cow, a man thinks he pays a big price if he gives £10 for her; but he would have to give double as much in England, where cows produce no more. The £10 would be repaid by the cow in one year if she were any good, and of course a buyer would have to remember that a seller did not sell his best cows as a general thing. If a young man wanted to make an economical successful beginning, he would advise him to go to a dairying district, buy fifty heifers from 1 year to 18 months old at (say) 70s. to 80s. If they were secured a year before he intended to commence, by the time he was ready they would be in milk, and would cost £8 to £10 to buy then. He would have no pick of his herd, but he could cull out (say) twenty of the fifty in the first year. A pure-bred bull should be chosen. The future of a herd depends upon the bull, and a pure-bred animal was essential, as he must be expected to reproduce his own good points, a thing which a cross bred bull, however good himself, could not be trusted to do. This great lesson had been taught to the dairy farmers by the introduction of the Government bulls. No man must say he cannot afford a good bull, for there is nothing in keeping a herd that will not keep him. A merchant in his business charges the cost of

producing the article before estimating his profit; so should a dairyman charge the cost of labour (even if done by his own family), of food, and other expenses, and see what his cow turns him in. Take three cows as an example, and assume that the annual cost of attending each was £5. The first might produce 100 lb. of butter, which, sold at 1s., would turn in £5 a year. That cow is not worth keeping; 100 such cows would not be worth milking. A second cow might produce 125 lb. of butter. She would be worth 25s. per year to her owner. Another might produce 150 lb. One of her sort would be better than two of class No. 2. Of course his estimate of production was very low, but he wanted them to realise the point he was making, that a good cow mus tbe secured. Success could only be achieved by bringing a herd up to a certain standard, and the bull is the animal that grades up a dairy herd. Do not buy a cheap bull; a good one gets fifty calves a year. Say half of them are heifers; you keep him (say) three years; he thus produces seventy-five heifers. Put seventy-five good heifers against seventy-five bad ones and you see the difference. Therefore, whether it costs £1 or £10 more, get a good bull; it is the greatest economy. Rather than use a bad bull, farmers should beg, borrow, or steal a good one. Wool men do not mind how much in reason they pay for a ram to improve their flock; so should a dairyman regard his bull.

Rearing the Calves.

The next matter is in regard to rearing the calves. No matter how good they are, they might be spoilt as a milk-producing animal unless properly reared. The tendency of a calf is to lay on flesh. There is no necessity to bring a calf up on a cow. Two bad results are liable to follow if it is done,—it gives a tendency to beef, and the milk of the cow is always poorer. That is a matter they could prove for themselves, and the point had been tested hundreds of times. When born, some leave the calf on the cow for twelve or twenty-four hours. At many dairies they take the calf as soon as they notice it; at others they leave them on for two or three days. This method has its good points. The main advantage is, that it is thought that thereby the tendency to milk fever is obviated. He preferred, on the whole, to take the calf away as soon as it is noticed. Give it its mother's milk for the first week, as the milk of a newly-calved cow is of special quality, containing certain medicinal properties which are good for the young calf. The calf should have new milk for the first three weeks. The amount could be lessened gradually after two weeks, and substitute separated milk. Any sudden change brings about digestive troubles, and is one of the chief causes of scours. At the end of the fourth week the calf need be given no new milk, but something must be substituted for the fat which has been taken from the milk. That is an easy matter. Boiled crushed maize, fed with the milk, is good and cheap; but linseed oil cake is best. Two ounces daily, mixed with the milk, gradually being increased to 4 oz. as the calf grows; dissolve in hot water and mix with the milk. Always feed the milk warm. The cow's milk is at a temperature of 100 degrees, and the thing is to follow nature as closely as possible. The milk must be given under clean conditions

It is not good to feed from a common trough unless the calves are graded. Nothing goes bad more quickly than milk, and any left in a trough turns bad, and contaminates the fresh lot when put in. It acts as a starter for the new lot, which might not turn bad there and then, but will do so in the calf's stomach with injurious results. At four months—or, anyhow, six months—old, the calf will be fit to turn out. In the meantime, it would have learned to graze, and therefore good, clean, sunny paddocks should always be provided, and the house they use absolutely clean. If the calf-scour germ once gets under the boards of the calf pen floor, you will have it every year until you shift the pen. The young heifer will be turned out from the time she is six months old till eighteen months, and then all depends upon her treatment when being brought into milk. If the heifer is on the beefy side, she should be sent to the bull younger than otherwise, as this is the only way to develop the milk-producing tendency, and to counteract the beefy tendency. The dairyman is frightened of stunting the cow by having her in calf too young, but there is nothing else for it if she is of a beefy tendency. The only way then is to give the young cow four or five months' rest after dropping her calf before putting her to the bull again. Thus she gets a chance to develop, and at the same time a start has been made in developing her milking qualities. It is a great mistake to milk a heifer for two months and then turn her out. She should be milked just as a grown cow.

Breeds.

The dairyman need not have pure-bred cows to commence successfully. His type will be developed by the bull he keeps in a couple of generations. A cross-bred cow will yield as much milk as a pure-bred if bred on right lines. Each dairyman should make his selection to suit his circumstances. It would be folly to try to keep Shorthorns on poor land, and it would be unwise to keep the small breeds on good land if you wanted to make something out of your steers. If a man has a good run, and wants to get something for his steers, his attention should be confined to three or four breeds—the Shorthorn, the Red Poll, Holstein, and the Kerry. The Shorthorn is an ideal cow if the land is rich, but they are not suitable where plenty of good fodder could not be got without much exertion. The small breeds will forage for themselves. The Red Poll has all the good attributes of the Shorthorn on a smaller scale. It is one of the most valuable of breeds. It is hardier and a greater forager than the Shorthorn, consequently will do on poorer pastures. The Holstein is perhaps the greatest milking breed in the world, having been bred for the milk-pail for 2,000 years. A cross with the Shorthorn gets good steers. The milk is not as rich as the Shorthorn, but it partly makes up for that in giving a larger quantity. The Kerry must not be confused with the small breed, the Dexter-Kerry. The Kerry will cross well with the Shorthorn, and will hold its own anywhere. On light lands, with deficient rainfall, where a regular supply of green fodder is not available, it would be hard to get a better animal; this will be found especially true in New England.

As for Jerseys. Guernseys, and Ayrshires, these small breeds did not give a revenue from steers, and the best thing to do with the bull calf was to knock him on the head. Take the Jersey as a valuable butter breed, with an eye for nothing else. She gives a fair quantity of extremely rich milk. There is no better butter cow in the world. It is a false impression to think they are delicate; the fact is, that there is no tuberculosis on the Channel Islands, and the United States admit Jerseys without the test. There are two classes of Jerseys. Seeing that so few Jerseys had been imported, he did not know where all the thoroughbred animals come from. (Laughter.) Put a Jersey bull to any class of cow and the progeny will probably be of good colour. He had seen quarter-bred animals shown as pure-bred; and what could be expected of their progeny than weeds. The proper English Jersey should have plenty of substance. He had seen these seven breeds referred to running together under the same conditions, and the Jerseys were certainly not delicate. They would not stand the cold like Ayrshires or Kerries, however. Crossed with a Shorthorn, the Jersey produces a good calf, but he would not advise crossing with the small breeds.

The Guernsey cow promises to be the most popular breed in New South Wales. Perhaps a thousand years ago the Jerseys and Guernseys were all the same breed; now they are very different. The Guernsey is larger and coarser, consequently hardier towards the cold. It has been used for draught purposes once, which should account for its size compared with the Jersey. It crosses well with the Shorthorn, Ayrshire, and Holstein.

About Milk and Cream.

Now, to say something about milk and the care of cream. When the milk is drawn from the cow, it is at a temperature of about 100 degrees, and that is the right heat to separate at. Never separate at less than 90 degrees, or there will be a loss of cream. When the cream leaves the separator it must be cooled, and that is why it should be delivered as soon as possible to the factory. The time must come when cream must be delivered daily. It is the only way to make first-class butter, and the farmer would get a better test sample. Stale cream will not supply a good test sample. It is a bad habit to pour your hot cream of one milking into the cold cream of the previous milking. Separate into another vessel, and, when cool, mix and stir thoroughly. Afterwards, the more cream is stirred the better, as a fresh surface is continually being presented to the atmosphere. Some farmers never stir, but allow froth to accumulate on the milk; nothing is worse, for the cream at the bottom becomes sour, and affects the whole lot. Dairying, except on clean lines, is impossible. A dirty man is an enemy to his district, as his product might mix with others and spoil the whole output. He urged farmers to go in for ensilage. It is the easiest thing in the world to make; it only wanted cutting at the right stage, and would keep one year or ten. He thanked them for their attentive hearing, and would be very glad to answer any questions.—*Tamworth News.*

An Act for the Protection of Dairymen.

An Act in force in some American States.

Section 1. All bottles, pipettes, or other measuring glasses used by any person, firm, or corporation, or their agents or employees, at any creamery, butter factory, cheese factory, or condensed milk factory, or elsewhere in this State, in determining by the Babcock test, or by any other test, the value of milk or cream received from different persons or parties at such creameries or factories, shall, before such use, be tested for accuracy of measurement and for accuracy of the per cent. scale marked thereon. Such bottles, pipettes, or measuring glasses shall bear, in marks or characters ineffaceable, the evidence that such test has been made by the authority named in section two of this Act. And no inaccurate bottles, pipettes, or other glasses shall bear such marks or characters.

Section 2. It is hereby made the duty of the Director of the State College Experimental Station, or other competent person designated by him, to test the accuracy of all bottles, pipettes, or other measuring glasses used by persons, firms, or corporations, in this State, buying or pooling milk or cream, or apportioning butter or cheese made from the same, by the contents of butter-fat contained therein. The Director of the Experiment Station, or the person designated by him, shall mark such bottles, pipettes, or other measuring glasses, as are found correct, in marks or characters which cannot be erased, and which marks or characters shall stand as proof that they have been so tested. The Director of the Experiment Station shall receive for such service the actual cost incurred, and no more, the same to be paid by the persons or corporations for whom it is done.

Section 3. Any person, either for himself or in the employ of any other person, firm, or corporation, who manipulates the Babcock test or any other test, whether mechanical or chemical, for the purpose of measuring the contents of butter-fat in milk or cream, for a basis of apportioning the value of such milk or cream, or the butter or cheese made from the same, shall secure a certificate from the superintendent of the dairy school at the State College of Agricultu· · and Mechanic Arts, that he or she is competent and well qualified to perform such work. The rules and regulations in the application for such certificate, and in the granting of the same, shall be such as the superintendent of that school may arrange, and the fee for issuing a certificate shall in no case exceed one dollar, the same to be paid by the applicant.

Section 4. Whoever uses, or has in his possession with intent to use, at any creamery, butter factory, cheese factory, or condensed milk factory, any sulphuric acid of less than one and eighty-two hundredths of specific gravity in the process known as the Babcock test, or any other test for determining the butter-fat contents of milk or cream shall, on conviction, pay a fine not exceeding twenty-five dollars for the first offence, and for a second offence a sum not exceeding fifty dollars. Any person, firm, or corporation violating the provisions of section one of this Act shall, on conviction, pay a fine not exceeding fifty dollars for the first offence, and for a second offence a sum not exceeding one hundred dollars; and any person violating section three of this Act shall, on conviction, pay a fine not exceeding ten dollars. And it shall be the duty of every inspector of milk, sheriff, deputy sheriff, and constable, to institute complaint against any person or persons violating the within-named provisions of this Act, and on conviction one-half of the fines shall go to the complainant and the balance to the State.

Section 5. This Act shall take effect in six months from the date of its approval.

[Approved March 27, 1895.]

Hogs for Small Farmers.

There is one advantage about pigs that make them emphatically the stock for the poor man or the small farmer, and that is the very quick returns which they afford, by the rapidity with which they increase and come to maturity. A good brood-sow given good treatment, so as to be kept in a good thrifty condition, will farrow two good litters of pigs a year that will run from seven to eight pigs in each litter; and if proper feed and care is given, these may be ready for market by the time they are eight or nine months old at the farthest. No other stock kept on the farm will make so good a return in so short a time. Sheep will come nearest it, but in the same length of time a pig will make double the weight of a lamb.

Another advantage with pigs is that they are marketable from the time they are farrowed until they are fattened for market. A sow with a litter of pigs, and growing pigs three, four, or five months old, will always sell at full market prices; so that the farmer is not obliged to feed them to maturity to get a little money out of them. With a little management pigs may be fattened to sell in the spring and fall, when it is possible to secure the best gain at the lowest cost; and when it is considered that they utilise much on the farm that would otherwise go to waste, it is only in exceptional cases that at least a few cannot be kept on the farm with profit.—*Midland Farmer.*

Farmers' Fowls.

[Continued from page 1214.]

G. BRADSHAW.

Chapter XXV.

Orpingtons for Meat and Eggs.

Having now given an outline of the circumstances which led to the inception of this breed of fowls, and an exhaustive history of its earlier troubles and ultimate triumph amongst poultry-keepers in every part of the world, it now remains to briefly give the attributes which were responsible for its present universality amongst poultry-men.

In England, it now holds pride of place amongst all breeds. Leghorns have many patrons, but fail in numbers in comparison with the breeders of Orpingtons. Plymouth Rocks have many devotees, but do not reach half the number of those who breed the English-made fowl; the runner-up in numbers being the Wyandotte. At the late dairy show in England, where the classes are for birds of the year only—no adults shown—the following are the numbers of exhibits of the principal breeds, which show the Orpington in England, as it is here, the most popular of all breeds, and most numerously exhibited.

There were on exhibition at the Dairy, Andalusians 27, Anconas 29, Brahmas 37, Langshans 37, Faverolles 44, Minorcas 60, Cochins 61, Hamburgs 64, Dorkings 77, Game 116, Plymouth Rocks 123, Leghorns 204, Wyandottes 343, Orpingtons topping the list with 350. Nor was this all, seeing that for the many new varieties of Wyandottes the extraordinary number of 18 classes had to be provided, which showed an average of 19 a class, while the Orpingtons had but 10 classes, being an average of 35 throughout. The largest display of Wyandottes was 32 Silver cockerels and 35 pullets, 35 White cockerels and 40 pullets, and 58 in the two Partridge classes. Coming to the Orpingtons, there were 31 Black cockerels and 45 pullets, 40 White cockerels and 65 pullets, while there were 59 Buff cockerels and the extraordinary number of 70 pullets, showing that the latter colour are still the most found in England. What has brought about this popularity amongst the English fanciers is the simple fact, whether of the Black, Buff, White, or other colour, the birds are of big frames, sturdy growth, easily reared and managed, and, whether kept as egg-producers or carcases for the market, if there were such a thing as best breed, the Orpington fowl would be the one. Beginning with

the Blacks, the market man will find them as quick growers as any fowl extant, and if well fed from hatching time, and otherwise wisely managed, the birds will reach 4 lb. each at 16 or 17 weeks old, the pure white skin and tender flesh warranting them a dish fit for any connoisseur in roasts.

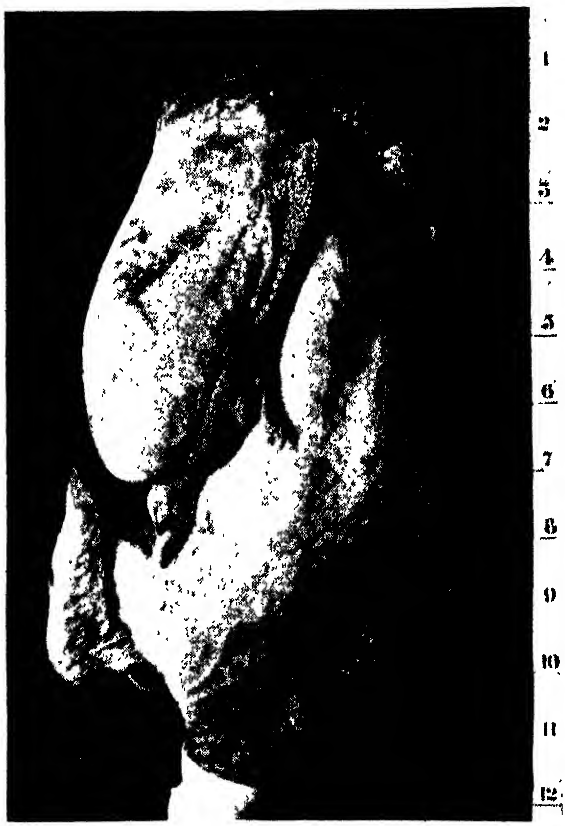
Excepting the Blacks, all Orpingtons have white legs, and, should an export trade in poultry products ever become an established fact, there is not a doubt but Orpingtons of the various colours will form the larger bulk of the business. At every table poultry show in England, Orpingtons, principally Buffs and their crosses, have usually secured many chief places in the prize-list, the latest being at the British Dairy Farmers' Association's annual exhibition in October last; in large classes, containing all the breeds but Dorkings, Buff Orpingtons were third and v.h.c., while in a good class of pullets, Lord Windsor won second with Buffs, reserve going to the same breed.

Well-meated Orpington Chicken.

In connection with exporting to London, the following from a London salesman, relative to a shipment of Sydney chickens a few years ago, may be repeated. The birds were largely Orpingtons and their crosses, and were shipped through the Agricultural Department. "The chickens, *ex* 'Australasian,' made 4s. each, and were very fine. Only get them here earlier, and any quantity can be sold at from 4s. to 5s. each with no difficulty. They are the finest frozen chickens that come to our market, and the way they have been killed, dressed, and prepared, is deserving of every praise. Although there have been large quantities of Canadian, Russian, Hungarian, and other varieties, there is no comparison between them and the chickens from Australia."

The chickens referred to were shipped by Messrs. Boyd, of Gosford; Gray, of Paterson; and Hoffman, of Parramatta. They comprised a

lot of good-sized birds, carrying plenty of meat, but certainly not the best that have been produced here. The "Australasian's" shipment left Sydney on the 5th May; the birds were sold in the first week of July, which is the tail end of the London season for frozen poultry. Considering that these birds, which could not be classed as the primest, realised so late in the season a price that will clear the breeders here over 6s. per pair, all doubts vanish about there being a profitable outlet in London for Colonial poultry of the right sort at the proper time of the year.



Black Orpington Pullet, showing a long, meaty breast.

As market poultry, Orpingtons have short legs, free from feathers, wide and deep in body, full breast, the frame excellently suited whereon to quickly build meat; and for those who intend going in for breeding poultry for market purposes I can safely recommend this breed as one of the first they should try. In breeding them pure, and properly treated, they make most excellent carcases, and can be as cheaply brought to a marketable stage as any known variety, while for crossing purposes Mr. W. Cook's testimony will be conclusive, wherein he says:—"Cross-breeding in the past has not been looked upon favourably by old-school breeders, whose conservative notions have

always hindered progress like this; but in many instances advanced spirits of their generation have indulged in this to a certain extent, and so many crosses have been tried with good results. If I may be permitted to give a piece of personal experience, I may say I have learnt more of the real value of breeds through crossing than by any other means, and it was while crossing that I gained that insight into the characteristics of the various breeds which enabled me to choose out the best varieties with which to build up the various Orpingtons, which are now so popular."

Buff Orpington—Faverolle's Cross 6 months old; weight, 7 lb.

Orpingtons can be bred profitably for the markets, while for those who prefer cross-breeding there are several breeds which can be judiciously used. A Dorking cock, if mated with eight or ten Black, Buff, or any other colour Orpington hens, will make a breeding pen of the very first order. They grow quickly, feather fast, and are in killing condition at almost any age from four months. A short-legged Colonial Game, or Old English Game, cock, if mated with the same number of hens, can also be recommended. The chickens from these will be more plump than the Dorking cross.

Coming to the breed's merits as egg-producers, such is of the very highest order, and despite the fact that it is an acknowledged principle that the best table qualities and an excess of egg-production cannot be found in any breed, Orpingtons go very near to dispel it; and, indeed, had the Buff variety equalled the Blacks at the various laying competitions in this and other States, such would have gone a long way in establishing the Orpington as the best all-round fowl, and the Buffs the best of the several varieties.

Regarding the laying competitions, there is no need to rehearse all the records made; suffice to say that as egg-producers the following figures are incontrovertible. At the second International Laying Competition at the Hawkesbury College, which began on the 1st April, 1903, and continued for three months, out of seventy pens competing, one pen of six black Orpingtons entered the contest at 7½ months of age, and completed the year's work with 1,274 eggs, or almost eighteen dozen for each hen. The contest was both Interstate and International, this pen of New South Wales Black Orpingtons beating every breed and every pen, one excepted, that being Wyandottes; and, had weight of eggs been considered, the Orpingtons would have won, seeing that the eggs weighed 25 oz. to the dozen, as against 24 oz. for the Wyandottes; while, taking all the Black Orpingtons in the competition, bad layers and good, 84 birds in all, they averaged 168 eggs each, or fourteen dozen for each hen, a performance of the highest order, and not responsible to any artificial foods, spices, balanced rations, or other of the now many things guaranteed to make hens lay; the food was of the simplest, and those electing to take up this breed, or any other for that matter, for the purpose of a plentiful egg supply, need not go beyond the simple formula which is embodied in Mr. Thompson's report, as follows:—"The hens have been fed on the simplest diet possible throughout the competition. The morning meal consisted of bran and pollard mash at 7 o'clock. The mash was scalded with liver soup two days a week, and on the other five days it was simply mixed with water, the quantity given being an average of about one Imperial pint per pen, the big eaters taking considerably over a pint, and the small eaters a little under. In the afternoon, between 4 and 5 o'clock, the hens were grain-fed, one pint, more or less according to appetite, of crushed maize, and sometimes wheat. Cut-up liver was given twice a week, at the rate of about 2 oz. per head. Shell grit was always before them, and clean water was given every morning. In the way of green food, rape was fed for three months during the winter, when the grass was withered. For the other nine months, the only green food the hens got was the natural grass in the pens. The rape was fed whole in the leaf, at the rate of a dozen leaves to a pen every second day."

Coming to the later College competition, which commenced when the preceding one closed on the 1st April, 1904, 100 pens competed, and although there was a diminished egg yield in all the breeds from the previous year, Black Orpingtons still held a high position, the 108 birds averaging 159·48, or over thirteen dozen for each hen. The same number of Silver Wyandottes competed, these averaging 145·30

eggs, or a point over twelve dozen eggs each, and although the highest pen of Orpingtons only got fifth place, they were only less than a dozen each below the winner, while there were twelve pens of other pens and varieties lower than the lowest of the Black Orpingtons. As in the previous contest, the highest pen of Black Orpington's eggs weighed 25 oz. to the dozen, as against 24 oz. laid by the winning Wyandottes.

So far as the present 1905 contest has gone, the Orpingtons are again placing beyond the region of doubt their reputation of egg-producers of the highest order, Blacks again being ahead of the Buffs. For the seven months beginning April of the present year, a pen of Blacks have laid over ten dozen each at the Hawkesbury College; while, going to the Rockdale competition, of the fifty lots competing, two pens of Black Orpingtons are leading with over twelve dozen each for the seven months The laying competitions in the other States exactly confirm the experience here, for although but in rare instances have a pen of Orpingtons topped the score, taking them as a breed in every instance, they performed excellently. In the first Victorian contest, which concluded on the 30th April last, a pen of six Black Orpingtons from Wagga laid in the twelve months 1,228 eggs, or over seventeen dozen for each hen, while all the Blacks in the same competition performed just about as they did in this State, namely, about fourteen dozen eggs for each hen, which goes to show that, whether for eggs or meat, or both, of all the new breeds or old, or of whatever inception or nationality, as a farmer's fowl nothing has yet been introduced to this country from England or elsewhere to surpass them.

Chapter XXVI.

Breeding Orpingtons.

When writing on these fowls a number of years ago, I invited and received contributions from a number of its then prominent patrons, and were any testimony desired as to its profitableness, the very fact that in this age of new breeds and varieties the then advocates and breeders of Orpingtons continue doing so still, and what was then said by various writers has been verified by later experience. However, since that time other Orpington enthusiasts, and successful ones, too, have come on the scene, and divided honours with the old-time exhibitors to an extent that, when a leading show now takes place, the good Orpingtons are so numerous that many specimens of sufficient merit to win prizes in the olden days are now left cardless, and, although the bulk of the then prominent successful winners continue to win, at the same time a few of the later recruits are now disputing premiership with those of earlier experience, with the result that the breeder who can win a couple of prizes in the Orpington classes now-a-days is considered lucky indeed.

It need scarcely be said that to now secure show-pen honours, breeders must first secure well-bred stock, and give great thought to the mating, breeding, and rearing, and be thoroughly acquainted

with pedigree, strain merits, and defects of the stock birds they use, and then, when all is done, it will be a good season indeed if two or three winners are produced.

The experience of Messrs. Ramsay, Pemell, Butcher, Grantham Farm, and others are already on record, and that of one or two of the newer patrons will now be given; nor has the success of these latter breeders been due to a lengthy purse, thus enabling them to import English prize-winners, but rather the success which has attended their breeding operations is further proof that just as we need not go to other countries for Orpingtons as egg-producers, neither is it necessary to go beyond our own shores for Orpingtons possessing that type and size which is considered essential in producing prize-winners.

Mr. E. Waldron, of North Sydney, is one of the most successful breeders in this State—a frequent prize-winner here and in Victoria,—and supplies hundreds of pounds' worth of stock to other States. Mr. Waldron's Orpingtons have kept him for years, and this is what he said to a representative of the *Sydney Daily Telegraph*:—

"I have been breeding for utility," he says, "for the past ten years, and have kept Black Orpingtons only. I am so satisfied with the results that I have no intention of making a change. For breeding I select close-feathered hens with broad shoulders and good chests. These three points they must have to suit me. A hen should also carry as much of her body in front of her legs as possible. The moment you get a hen that carries a great part of her body behind her legs, she develops fat, makes a poor layer, and her eggs will not give 25 per cent. of chickens. I have bred some very fluffy Cochiny birds, but find that they all develop fat very early, and at twelve months look like very old hens. For laying, breeding, or table, I would not care to keep many of them. On account of the fat and extra fluff, they get credit in the show pen for being low set, and will knock out a close-feathered bird that is actually shorter on the leg. I have proved this with my own birds. I am not a believer in either short or long legs. I like to see a bird with legs in proportion to its body. It is just as easy to breed one as the other. If you want the fluffy type, all you have to do is use a fluffy rooster, and you will always get it; but if you want layers, my advice is choose close-feathered hens, with bodies carried well forward, with broad shoulders, and good full chests."

Another prominent poultry-breeder who, within the past few years has gone in for Black Orpingtons, and with unprecedented success in the time, is Mr. H. Cadell, of Wotonga, Epping. This breeder appropriated the *Daily Telegraph* cup for the most successful Orpington exhibitor at this year's Poultry Club Show, securing two firsts and champion and two seconds in Blacks, and three of the firsts in Buffs, a record hitherto rarely approached, and as showing how this success was attained, and as a guide to those not already in the know, Mr. Cadell contributes the following, entitled "How to Breed Prize-Winners."

"In mating Black Orpingtons, the colour question is not so acute as in their younger relations, the Buffs; but to obtain the beetle-green so essential in the variety, care must be used in choosing a male to see that he is green all over and down on to the soft feathers covering the thighs, and fluff should also be green; he must be short on leg, full and round in breast, and dark in eye, in fact, a black or bull eye is preferable to the standard 'black pupil and dark brown iris.' In a stock cock, back short, broad at saddle, tail full and flowing—if carried a bit high, do not discard an otherwise typical cock, as a bird showing this fault is usually the sire of very short-backed progeny,—a neat head, clean-cut comb, and, although he may not prove a show-pen champion, his stock, if mated as I suggest, will be. Two years ago I purchased a cockerel at the Royal that could only get commended, giving £10 10s. for him, the winner going for £7 7s. The fowl I bought was a wonderfully blocky, large-chested fellow, and in choosing mates for him I went for short-legged, roomy hens, black in eye; the cockerel failed here, a couple in the pen showing an ample cushion, to get broad backs into the cockerels, and also to keep the tails moderate in size, with abundance of side hangers, and full saddles. The balance of the hens were tighter in feather, neat heads, and very deep in front as well as behind, depth being needed in a hen to give ample room for the 'egg department,' as in a heavy milking cow. Each hen was moved to the pen after careful study and with a definite object, all the while keeping in view the pedigree of each hen. A record of over forty-eight firsts, two silver cups, and numerous other awards for stock from this pen in New South Wales, Victoria, Western Australia, Tasmania, and New Zealand, all won at leading shows, is a guarantee of their show quality, and a pen of six exhibition pullets have laid from being mated end of July to end of October, and not one broody, speaks for them as farmers' utility fowls. I would strongly urge buyers to give more attention to pedigree if wishing to buy to show; and even after all the almost hysterical stuff one reads of so-and-so's marvellous egg-laying strain, a little quiet inquiry will usually prick that bubble, and one finds so-and-so's bred-to-lay strain are the culls from a show fancier's yard. An experienced breeder, who has a few years' show-pen successes to back him, is always more reliable than one of mushroom growth, and even the latter is away ahead of the dealer. Do not expect champions and quite perfect specimens; the former are always in demand at tall figures, while the latter have not been seen yet, although some point-judging cranks have scored fowls as high as 98½ out of a possible 100 at Sydney shows.

"While calling the Black Orpington a grand farmer's fowl, and by farmer I include all dwellers on the land, I think in a couple of ways the younger variety of the Orpington, *i.e.*, the Buff, has a pull over the Black. For eating purposes I place the Buff an easy first, while the colour of the stub feathers, and there are always a percentage of these that remain, does not disfigure the carcase like the Black ones. I have found they more readily fatten, and put on more breast meat; then, by the poulterer, the white leg is much preferred. As Winter

layers of nice tinted eggs, they run away from the Blacks, and as all my surplus eggs go to the leading grocers of Sydney, where each lot are weighed, I have never had a word about the egg being under weight, while their tendency to become broody early I consider their greatest point. During the past season I have raised about 500 chickens, about 400 being hatched by hens, and out of all I have set, but five were Blacks, and to a farmer early sitters are valuable, as early hatching means Winter eggs the following year, as well as meaty saleable cockerels by Christmas. When the Buffs are not required as sitters, if put away first time found on the nest after dark, they soon come laying again. As mothers they are unequalled, and many hens lay with chicks three to four weeks old, and still brood the chicks. If I had to choose one variety for commercial purposes, I would go straight and keep Buff Orpingtons only.

"As exhibition fowls they are very hard to breed to the one even shade of rich buff all over; but, after five years' careful mating, I find a much greater percentage of the chickens are coming true to colour, less black and white in tail and flights, and less leggy. To raise Buffs for show, careful inbreeding is an absolute essential, and if buying for producing show birds, ware the yard that is always introducing fresh blood. Just watch the show-pen, and though such haphazard breeders may occasionally score, the scientific breeder will average better. For getting show birds, use a sound, even-coloured male, and mate him to close blood relations, and, if of good pedigree, you will not be disappointed.

"I hatch principally with hens, and, when convenient, put two or three hens down at same time, and, when hatched, give all the chicks to one, coop her snug and dry, and the other hens can go back to laying. I have an incubator and brooders—Cypher's, about the best—but you cannot beat the hen. I feed on dry food, plenty clean, cool water, shade and shelter of the trees, and kill all weaklings as early as possible—that is, directly found. As they get to four to six weeks, I feed soft food of a morning, boiled grain at midday, meat twice a week, and dry oats, maize, barley, or wheat at night."

With all that has been now said about this breed of fowls, it will be apparent that for the exhibitor whose desire is prizes and their contingencies, or the farmer whose object is the greatest quantity of eggs and meat, there is no breed of domestic poultry which can be recommended to have greater all-round properties as that now so universally known as the popular Orpington.

(*To be continued.*)

Bacon.

A Report from the Agent-General.

The Honorable the Premier and Colonial Treasurer has received a report from the Agent-General, in London, stating that six sides of New South Wales bacon, shipped by various factories through Messrs. Dalgety & Co., were borrowed for exhibition, with our exhibits at the Grocers' Exhibition, at the Agricultural Hall, Islington. As far as the quality of the meat was concerned, this bacon was unanimously commented on in favourable terms. The only criticisms met with were in regard to the butchering and dressing of the sides in one direction, and in connection with the size, shape, and fatness of the sides in another.

With reference to the butchering, the chief faults found were that the aitchbone and bladebone had not been removed, and that the knuckle had not been sawn off sufficiently close to the gammon; also, that in taking out the backbone, too much meat had been removed with the bone, thus spoiling the concave appearance of the back of the side, so far as meat is concerned. The back being one of the most valuable parts in this country, and the general taste being in the direction of a fair amount of lean, it is advisable that this point should be studied.

With respect to the sawing of the knuckle, it is sufficient to say that the knuckle should be sawn off as close to the gammon as is compatible with not causing the meat to "string away" from the bone.

In connection with the size and fatness of the sides, it is necessary to point out that in this country there are two markets—the London and Provincial—and that they differ absolutely in their requirements. London wants a small, lean side of bacon, whereas the provinces generally, and particularly the agricultural districts, require a large, fat side—the fatter the better. Of the sides exhibited at the Show above-mentioned, some fulfilled the London requirements, and some the provincial, proving that New South Wales can supply both. There is one point in connection with this matter, which is outside the questions of dressing and size, and that is shape. The ideal shape of a side of bacon is a small fore-end, and good thick concave middle cut, and a heavy, well-rounded gammon.

In this particular our bacon is somewhat deficient at present, and the fact was noticed by every practical man who examined it at the Show. It was described by a big man as too "piggy." This is, of course, a matter which can be altered only by close attention to the question of breeding for bacon, *per se*; but that it is necessary in the best interests of the industry, there can be no possible doubt.

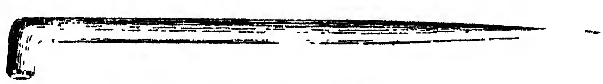
In view of the existence of several excellent studs of pure breeds of imported pigs at the Hawkesbury College, Experimental Farms, and

Rookwood, Liverpool, and Newington Asylums, it might prove of educational advantage if certain types of pigs could be utilised for bacon, to be submitted to the trade and to the public in Great Britain for specific criticism and report. The bacon could be shipped in cool storage unsmoked, and the smoking could be carried out in England.

The prospects of export trade are encouraging enough to justify special efforts to ascertain the precise requirements of London and country buyers of bacon. In order that exporters may have perfectly authentic guidance, it is suggested that in each case one side of the bacon from a carcase be forwarded to London, and the other side be kept in Sydney for reference. When the English reports are received, a copy of them could be attached to the "reference" sides.

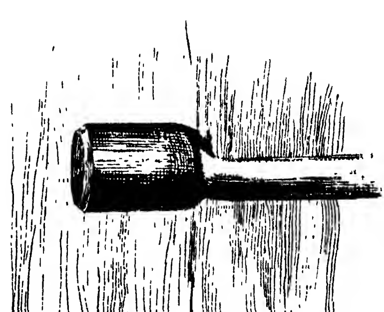
Wire Fencing.

Mr. Elliott J. Rien, Myee, writes, enclosing a sketch, which is reproduced, of a simple tool for plugging wire fences during the process of straining. In the October *Gazette*, page 960, in an article "Hints on Fencing," the plug



Iron Plug showing hook to facilitate removal.

shown in the illustration is of a bad shape, being too short and dumpy, which would be hard to get out. With a tool such as Mr. Rien uses there is no difficulty in removing the plug. It is made of round bar-iron, 15 to 18 inches long, and about ¾ inch thick, tapering to a point, commencing about 8 inches from one end; a hook is turned up 1½ to 2 inches at the other. Now, when the wire is strained sufficiently tight, drive this peg into the hole, keeping the wire at the side of the hole, and it will hold securely while fastening; if the wire is allowed to press against the top or bottom of the hole it is very apt to bed into the grain of the post and slip. When the wire is fastened the peg can be knocked out with an axe or hammer by striking on the hook. Any blacksmith would make this for a few pence, and the saving in time is very great.



Showing the plug holding wire against side of hole in straining post.

Reports from the Commercial Agents.

South Africa.

Canned and Bottled Fruits.

The Minister for Agriculture has received the following reports from Mr. Valder, the Commercial Agent at Cape Town, saying:—

The following are the returns of the imports into South Africa, through British ports, of canned and bottled fruits during the past four years:—

	1901.	1902.	1903.	1904
Imported from—	lb.	lb.	lb.	lb.
United Kingdom	2,015,737	1,259,484	790,483	628,028
United States .. .	2,257,996	2,221,230	858,313	682,578
Australia	923,492	746,604	253,363	488,303
Other countries	70,829	115,674	223,049	244,677
	5,268,054	4,342,992	2,125,208	2,043,586

It will be seen that there has been a great falling off in the importations of canned and bottled fruits, but the years 1901 and 1902 were abnormal, and I think that we may conclude that the imports of 1903 and 1904 represent the normal imports. The imports from Australia during 1904 nearly doubled those of 1903, and I believe that the trade would have been much greater had it not been that there was considerable difficulty in obtaining a regular supply. The same trouble is again occurring this year. The merchants state that the Australian brands of canned fruits are giving great satisfaction, the canning and get-up generally being first-class, and the fruit often being equal to or even superior to that of the finest Californian brands; but the trouble is that the Australian canners do not appear to be able to keep up the supply. One large Cape Town firm reported that they had received a sample consignment of canned fruits of a new brand, and that the fruit was so satisfactory that they at once cabled for a further supply, but that they were astonished to receive the reply, "Regret cannot supply any more canned fruits this season." The general opinion is that both quality and price are satisfactory, and that with a more regular supply this trade could be greatly extended.

The latest quotations for Californian canned fruits, f.o.b. New York, are as follows:—

	Currency.	Sterling.
Extra Standard California Crawford Peaches, 2½s., 2 doz. to case, per doz.	1·75	7/1½
,, ,, Lemon Cling Peaches, &c., 2½s., 2 doz. tins to case, per doz.	1·85	7/6¼
,, ,, Pears, 2½s., 2 doz. tins to case, per doz. ...	1·90	7/9
,, ,, Apricots, 2½s., 2 doz. tins to case, per doz.	1·50	6/1½
,, ,, Plums, &c., 2½s., 2 doz. tins to case, per doz.	1·45	5/11
Standard New York State Apples, 3s., 2 doz. tins to case, per doz. ...	·85	3/5½
,, Maryland Tomatoes, 3s., 2 doz. tins to case, per doz.... ...	·70	3/-
,, quality Sweet Corn, 2s., 2 doz. tins to case, per doz	·90	3/8
,, ,, Succotash, 2s., 2 doz. tins to case, per doz.	1·00	4/1
,, ,, String Beans, 2s., 2 doz. tins to case, per doz. ...	·90	3/8
,, ,, Peas, 2s., 2 doz. tins to case, per doz.	1 00	4/1

Standard fruits 10c. lower than the extra standards.

Of the 488,303 lb. of canned fruits imported in 1904 from Australia, New South Wales only contributed 26,237 lb., whereas Victoria supplied 245,781 lb., and Tasmania 215,536 lb.

The quantities given in the annual returns represent the nett weights of the contents of the cans, *i.e.*, the fruit and the syrup, upon which the duty of 2d. per lb. is payable.

Dried Fruits.

The Minister for Agriculture has also received a report from Mr. Valder, saying that the quantity of dried fruits imported into South Africa through British ports during the past four years was as follows:—

Imported from —	1901.	1902.	1903.	1904
	lb.	lb.	lb.	lb.
United Kingdom	4,360,993	4,945,644	3,812,211	3,038,402
United States	1,196,444	1,133,154	1,129,669	765,981
Australia.................	182,886	190,197	55,261	84,811
Other countries	310,631	523,602	797,814	1,278,549
Total	6,050,954	6,792,597	5,794,955	5,167,743

This means an annual expenditure of from £60,000 to £70,000 upon dried fruits. It will be noticed that there has been a decrease in the total quantity imported. This is due, I consider, to the general depression in trade, the increased local production, and to the fact that the demand in the years 1901 and 1902 was an abnormal one, caused by the presence here of such a large body of troops during the war. It will also be noticed that the imports from Great Britain, United States, and Australia have all decreased, whereas those from foreign countries have rapidly increased. As the dried fruits imported from Great Britain are grown in other countries, such as Spain, Greece, &c., and reshipped to South Africa, it was to be expected that, with improved conditions of transit between those countries and the Cape, the imports of dried fruits from Great Britain would gradually fall off. With America the decrease has not been much above the average. But with

Australia the imports are down to less than half what they were in 1901 and 1902. This was due to the low prices ruling here, and to the fact that Australian merchants could not quote for large quantities. Prices for most kinds of dried fruits have hardened of late.

The following are the latest quotations, f.o.b. New York :—

	Currency.	Sterling.
New York State Evaporated Apple Rings, cases, 50lb., per lb.	1·08½	–/3⅜
Fancy Evaporated California Apricots, 25lb. cases, or 40lb. wooden pails, per lb.	·12½	–/6
,, ,, Peaches, ,, ,,	·11½	–/5½
,, ,, Nectarines, ,, ,,	·09½	–/4⅜
,, ,, Pears, ,, ,,	·13	–/6½
,, ,, Prunes, 40/50s., 25lb. tins, or 40lb. tin pails, per lb.	·07¼	–/3⅜
,, ,, ,, 50/60s. ,, ,,	·06½	–/3¼
,, ,, ,, 60/70s. ,, ,,	·06	–/3

(In 40lb. tin pails at extra cost of not more than 1c. per lb.)

The prices quoted for apricots is high, and should admit of Australian fruit coming in ; yet, only this week, a large Cape Town merchant told me he was not able to get Australian apricots at this price. As a rule, especially for the up-country trade, the merchants prefer to have the apricots, peaches, prunes, pears, &c., packed in tin pails, for which they are quite willing to pay the extra ½d. per lb. charged by the American packers. Of course, a large portion of the fruit referred to in the annual returns consists of currants, raisins, figs, dates, &c., nearly all of which come from Southern Europe ; but there is also a considerable importation of apricots, peaches, prunes, pears, &c., a large portion of which comes from California, and it is in the latter fruits that Australia should be able to increase her share of the trade. With regard to the locally-produced dried fruits, their production has not increased nearly as rapidly as was expected. It has been proved that many parts of the Cape are well suited for the growth of varieties of fruits suitable for drying, and that the climate is so favourable that, in most seasons, these fruits can be dried in the sun with little or no artificial aid. Recognising this, the fruit-growers here have, for some years past, produced large quantities of raisins, sultanas, apricots, prunes, &c. The grocers maintain that the local sultanas are equal to the best imported, and that the cooking raisins are of such good quality that there is no need to import. Some good samples of apricots and prunes are also produced, and sell in Cape Town at 6d. per lb. for the 25lb. box. A very large portion, however, of the local dried fruits are of inferior quality, the fruit being small and badly got up, some of the samples of these exhibited in the windows of the small grocers' shops in Cape Town being about as unattractive in appearance as one could well imagine.

This production of such a large percentage of inferior dried fruits has resulted in a large portion of the people preferring the imported fruit, for which they have to pay at least 50 per cent. more, and I think that we may safely assume that there will be a demand for good quality dried fruits here for many years to come.

Broom Millet.

Mr. Valder will be glad to have particulars of price and size of bales of New South Wales broom millet, d.d., c.i.f., South Africa, and where a c.i.f. price cannot be given, then a quotation f.o.b. Sydney. Parties contemplating attempting to export millet broom will require to pay particular attention to quality and even character of the millet throughout each bale. Millet bales not of fair quality throughout and unable to pass inspection would probably not meet the requirements of purchasers.

JAPAN.

Fruit, Jam, Wine, &c.

The Minister for Mines and Agriculture has received a report from Mr. J. B. Suttor, at Shanghai, wherein he makes mention of trade in fruit, &c. He says there are not any statistics available as to the annual importations; but it would appear that a good business is being done in fruits from California, principally apples. Quite recently a shipment of Australian fruits reached the Shanghai market, where there is a fairly good demand for apples and oranges, &c. Mr. Suttor was informed, however, that the trial shipment arrived in very bad condition, and solely on account of being sent as deck cargo. It is simply out of the question to attempt to send fruits to Shanghai without doing so in proper cooling-chambers. On arrival, over 80 per cent. of the fruit was found to be absolutely rotten. With proper storage the fruits should arrive in excellent condition, and a good business is capable of being worked up.

With reference to jams and preserves, Mr. Suttor has received a few inquiries from leading merchants, and he has placed them in touch with Sydney people, and is hopeful that business will eventuate. One large dealer asked Mr. Suttor to have a look at some Australian jam he had imported some time back. The quality was excellent, but the tins bad, and the general get-up defective. When the tins arrived they appeared to be fairly good, but later on they exhibited nasty marks, and the paper wrappers faded, and otherwise gave the tins a very dirty appearance, thus preventing sales. As previously pointed out, shippers and manufacturers must adopt methods equal to the English jam makers before there can be success with the article on the China market.

As to wines, Mr. Suttor has been given to understand that some samples sent have proved satisfactory, and that small contracts are likely to be arranged for certain Australian wines. Australian brandy is coming into favour, and a small business is being done by Eastern agents, which may considerably increase during next year.

Licit and Improved Treatment of Grape Juice in Wine-making.

M. BLUNNO.

AGAINST the natural advantages of a reliable climate for the thorough ripening of grapes, there is the baleful influence of usually hot weather during the time when grapes are brought to the cellar to be made into wine.

February and March are hot months all through the vine-growing districts of the State, and a thermometer placed with its bulb in a heap of grapes will constantly show a temperature ranging from 70° to 80° F., and often higher still.

On account of the almost semi-tropical summer, grapes are apt to become overripe within the turn of a week. A percentage of grape-sugar varying from 21 to 25 is the usual standard of the musts of the districts with a larger rainfall, from 25 to 30 and over that of those where the rainfall is less. The generality of musts in Australia, few cases excepted, are deficient in fixed acids, which are as important as the sugar itself for a good fermentation and for the formation of those characters which concur to form the *tout ensemble* of a wine of a fine quality, that quality which is due to the contribution of so many factors, some of which are well-known, while others cannot as yet be collected into the chemical crucible, but are only seen with the mind's eye.

Wine-making conducted in the cool districts of Central Europe is a much easier work than in fairly hot countries, and, indeed, since viticulture began to be pursued in them, it was found by experience that the time-honoured practice of the old vine-growing districts were at fault. Hence scientific researches of the cause of so many troubles, which jeopardised the future of the industry in the newly-settled communities. The consequence was a general and startling progress in the application of science—a progress which, during the last twenty years, has been in uninterrupted ascendancy, steadily following in the wake of by micro-biology and micro-chemistry.

Special treatments of musts and wines have been tried and sanctioned by gratifying results—treatments, I say, which would have been condemned a few years ago without discussion, and would have been considered as manipulations, giving this word the meaning of illicit tampering with the vintage.

The destruction of vineyards caused by Phylloxera, which in the older countries caused many lands, not altogether fit for grape-growing, to be planted with vines with only one object in view, viz., large yields to make up the fall-off in the output, the numerous new pests which visited and became

endemic, spoiling the crop year in year out, required more scientific handling of the raw material to counteract the influence of so many causes of the deterioration of the product.

A score of different new methods of wine-making have been, during the last ten years, advertised by experts of more or less repute. I daresay each of these new systems may have some good points and be convenient under some special conditions. A number of patent chemicals have sprung up and are widely advertised, and the wine-maker is, often through ignorance, induced to use them and it may be in some cases he brushes with the Police Court.

I shall write in this article on the rational treatment of musts, in order to bring its chemical composition to a proper balance between its ingredients. The adverse season, the visitation of parasites, or the unsuitability of the soil may be the cause of excesses or deficiencies of some of the said natural ingredients, and the skilled wine-maker ought to remedy that which Nature has failed to do.

Tannic Acid.

Tannic acid is principally contained in the grape seeds, is also plentiful in the skin of red grapes, in which it is combined with the colouring matter. Skins of white grapes contain much less of this substance. Tannic acid is very largely distributed in the vegetable kingdom and its real chemical nature varies according to the source. The tannic acid of grapes is of a kind not found in any other fruit or plant, and is called œno-tannin. It is a sound keeping ingredient of wine and a factor of brilliancy on account of its faculty of combining with albuminoid substances, which are apt to cloud it more or less persistently. Brilliancy is obtained with greater difficulty in white than in red wines, exactly because white wines contain hardly any traces of tannin, while even in light clarets there is from ·8 to 1 part of this substance in every 1,000 parts of wine. The cloudiness in a sound wine is due to organic nitrogenous substances, which are in a state of semi-solution. Sometimes in some wines it disappears and the wine becomes bright, because the slow oxidisation which they undergo renders them totally insoluble, hence they precipitate to the bottom of the cask. Heat, as applied in pasteurizers, has the effect of coagulating the nitrogenous substances and determines their sinking. Intense cold, though to a lesser extent than heat, may have the same effect. Both these agents are greatly helped by the alcoholic strength of the wine, a higher quantity of alcohol enhances the desired effect. It is evident then that the strong aeration of white musts, or white wine, by stirring with some suitable contrivances, will secure their more rapid clearing. The first effect, in case of white musts, will be a thick turbid liquid, like a tank of water in which the clayey silt has been stirred, and in white wine the cloudiness becomes opalescent, because the substances which were in semi-solution begin to take consistence. Often two white wines, with almost similar chemical compositions and having received equal treatment, show a marked difference as to their respective limpidity. The reason, then, may be one of a physiologic character, and may be sought in the race of yeast which predominated in the fermentation.

The diastase secreted by the alcoholic yeast differ as differ the numerous kinds of leaven. Perhaps one diastase secreted by one sort of yeast may be more effective in coagulating the albuminoid substances than the diastase secreted by another. This assumption seems to be supported by experiments made with various kinds of ferments operating on different lots of the same juice. Some lots clarified very quickly, others took longer, others were persistently cloudy.

The tannin of grapes, like all other tannins, is apt to combine with organic nitrogenous substances and form tannates, which have solid consistence and therefore sink readily. This is the chemical principle upon which is based the fining of the wine. Red wines contain enough tannin for the purpose of a self-clarification; this, however, is often anticipated by the addition of gelatine or white of eggs in order to cause the formation of a kind of film which, by gradually sinking under its own weight, drags any solid particle previously suspended in the bulk. White wines, on the contrary, hardly contain one-tenth of the quantity of tannin which is found in red wines. The approximate proportion in which tannin and organic nitrogenous substances combine are 1 to 1. I said purposely approximate, for the reason that the influence of the chemical composition of the wine is paramount, because the quantity of alcohol, acids, extract, the bulk and temperature can all alter the 1 to 1 proportion, which, however may be taken as a mean. The quantity of albuminoids contained in white wines is quite in excess to that of tannin, and if such wines are often tolerably clear, it is not the action exercised by the traces of tannic acid, but that exercised by the alcohol which has power to cause their partial coagulation.

The presence of relatively large quantities of albuminoids will never cause the total precipitation of all traces of tannic acid. Excessive and repeated proportion of gelatinous or albuminous fining may be added to any wine, red or white, and yet all the tannin would never be extracted, the wine always retaining a proportion of it. Those of my readers who possess a knowledge of chemistry will understand that this is a fact regulated by the law of mass-action. When white wines remain cloudy, I always advise the addition of tannic acid at the rate of 2 oz. per 100 gallons, and double that quantity for the tannisation of the wine prior to the addition of the fining, be it isinglass, blood, or milk.

Tannisation of Musts.

To avoid the trouble of wines which will not clear quickly and thoroughly, it is advisable to add tannin to the musts before or during fermentation. This practice is not by any means new and has been in vogue in many districts in Europe for years, where wine-makers in a small way find that it improves the wine by letting the must of red or white grapes ferment with substances which are rich in tannin, such as chips of bark of oak tree, peel of pomegranate, &c. This is resorted to especially with grapes which are naturally poor in œnotannin, or in wet seasons, when musts are watery and moulds affecting the berries destroy the tannin contained in the skin. The method referred to is

rather crude, and has the inconvenience of not permitting the regulation of the proportion of tannic acid nicely, besides the risk of tainting the wine with strange tastes. No modern authority would recommend such an empirical process, and I mentioned it only in support of the modern idea of adding to certain musts a well-considered proportion of the purest tannic acid specially prepared for wine-making, which is free from the pharmaceutical smell of the commercial tannin. After the appalling havoc caused by phylloxera in France, some of the richest flats formerly devoted to horticulture have been put under vines. The Aramon, a red and most prolific grape, has been preferred by the majority, particularly in the south. This variety is rich enough in colour, but its must is extraordinarily rich in organic nitrogenous substances, all the more so when this kind of vine is grown in very fertile plains or valleys. I pointed out in the foregoing that the colouring matter of grapes is of tannic nature and, properly speaking, the tannic substances of same include also the colouring matters. It follows, then, that the excess of albuminoid substances will not only act on the œno-tannin but also on the colouring matter, as both gradually dissolve in the fermenting juice, thus a great proportion of colour, instead of remaining in solution, sinks with the lees. The addition of tannic acid to the must has, among the other advantages in this case, that of ridding the must of the surplus of such substances, which otherwise would eliminate portion of the colouring matter.

In wet seasons or when grapes have been spoiled by visitations of parasites, tannic acid mixed in the must is considered a great help, and satisfactory action is everywhere recorded. The yeast-cells like all micro-organisms are apt to be stained, and they are readily stained by the colouring matter of the wine. The countless millions of yeast-cells contained in a fermenting red grape-juice are responsible for the elimination of a good deal of the colouring matter. Their cells can also fix the tannin, natural or added, and the effect on the fermenting activity and prolificity is the same as that caused on live micro-organism by the action of stains. The cells of musts in which a certain proportion of tannic acid has been dissolved will remain smaller and will multiply less rapidly, hence the fermentation will proceed slowly, the sugar will disappear gradually, fermentation will take longer, and the quantity of heat corresponding to that of sugar will spread over a longer period of days and never rise suddenly and over-reach the critical point when the yeast, besides producing alcohol, yields also acetic and other acids which spoil the wine, while a number of other micro-organisms become also balefully active. Tannin therefore attenuates the fermenting power of yeast without changing its nature, a fact which tallies with that of a similar order of the stained bacilli of a virus which is purposely so treated in order to attenuate its power and be used for the immunisation of animals against certain infectious diseases. In the making of red wines, it is not considered necessary in the generality of cases to add tannic acid either before or after fermentation, because there is more than enough of this ingredient in the skins, seeds, and stalks, so much so that in many instances it is advisable to stem the bunches, that is, to separate the berries from the stalks. It is different however in the making of white wine. White musts contain only

traces of the natural tannin, because from the fermentation are excluded all the solid parts of the grape bunches where it is stored. The preliminary addition of tannic acid to musts before the beginning of fermentation or even in the act of fermenting or soon afterwards is a very commendable practice, because wines will clear quickly. The organic nitrogenous substances by quickly sinking and being soon removed through the successive rackings will be lost to the pathogenic micro-organism which feed on them and cause the various alterations of wine, the most common in white wine being the tartaric fermentation and ropiness. Tannic acid is *per se* a natural preservative. A certain proportion of it also gives wines "nerve," as European wine-tasters express themselves colloquially.

Tannin is, besides, the sovereign remedy against the *casse* of red or white wines, whereby the former lose their ruby tint, acquiring a doubtful rusty hue and the latter a dark dirty yellow, in both cases the wines becoming very turbid.

Quantity and mode of using Tannic Acid.

Tannic acid is soluble in the must and in the wine, but it would almost totally sink before it had time to dissolve all through the bulk if it were added in its powdery state. It is therefore advisable to dissolve it in brandy, 1 gallon of which will keep in solution as much as 2 lb. of tannic acid.

A suitable quantity of tannic acid to be added to the must varies from 2 to 3 oz. for every 100 gallons of juice. It is necessary therefore to prepare a solution of known strength and mix it in proportion to the bulk of must—for instance, suppose 1 lb. of tannic acid is dissolved in 1 gallon of brandy, every pint of this solution will contain 2 oz. of tannic acid. From 1 to 1½ pint of the solution would suffice for 100 gallons of must—that is, if you put 1 pint by so doing you add 2 oz., and if you put 1½ pints you add 3 oz. of tannic acid to 100 gallons of grape juice.

The quantity of tannic solution decided upon is first mixed with about 10 gallons of must, then these 10 gallons are added to the other 90 gallons and thoroughly worked together.

The opinion is divided as to when the solution should be added, some say before and others say during fermentation and others again after the must has become wine. The majority however agree that it is best to mix it before fermentation if grapes are not clean and sound or if the grapes are hot, which would naturally be the cause of a rapid and great increase in the temperature of fermentation with certain deterioration of the wine. The tannic solution may be mixed to the bulk after fermentation if grapes were sound, clean and cool, but were grown on rich flats.

Increasing Fixed Acidity of Musts.

Fixed acids are the free organic acids and acid salts of the must, their totality constitute what is called fixed acidity. These acids are the malic and tartaric acids and the acid tartrate of potassium.

Malic acid is predominating in grapes and is the same as that found in apples. Acid tartrate of potassium is the acid salt of the tartaric acid, is also called potassium bitartrate and colloquially called cream of tartar when pure and wine stone or argol in its raw state. Of the free tartaric acid small quantities are found in must or wine, but often in extra ripe grapes none at all.

Other vegetable acids are found in grape-juice, but only in infinitesimal quantities and always in unripe grapes. Grapes, when green, contain succinic acid, which however is normally found in wines in quantities that can be chemically estimated; but in this case it is a normal product of the fermentation of the sugar, like alcohol, carbonic acid, glycerine. Glycolic acid was found by Erlenmeyer, and oxalic acid combined with lime is also found in the well-known crystal formation of calcium oxalate, contained in the cells of many plant tissues, *raphides*, or needle-shaped crystals. Oxalic acid is characteristic of the sorrel-plant, *Rumex oxalis*. Such crystals found in the tissues remain in the husks and therefore must and wine are free from them.

When speaking of the fixed acids of the must it is only intended to refer to malic acid, to the potassium bitartrate and to free tartaric acid. In a thousand parts of must of ripe grapes the quantity of malic acid is about 3·5, that of the potassium bitartrate from 4 to 8, according to the temperature of the liquid and that of free tartaric acid from ·2 to ·6.

The acid power of the above-named substances varies, that is to say, that to the unit quantity of each of them corresponds a coefficient of acidity which varies from acid to acid. Malic acid is more acid than the tartaric and this is more acid than the bitartrate of potassium. This is the relation in which they stand as to their acid power taking tartaric acid as unit:—

Tartaric acid	1·
Malic acid	·893
Cream of tartar	·399

For all practical purpose it is quite sufficient to know the total acidity of a must. Therefore no separate chemical estimation is made of these respective substances. The total acidity is determined with a standard alkaline solution, and in the calculation the coefficient of the tartaric acid is preferred. To have a practical idea of the acidity of a must a comparative standard is taken. Tartaric acid is generally preferred as term of comparison, so the total acidity of must is calculated as if it were all due to the said acid alone. This simplifies matters, because instead of expressing the respective acidity due to the presence of the various acids isolately estimated, they are estimated collectively and referred to the unit acidity of one of them taken as standard. In some countries, in France, for instance, instead of calculating the total acidity of a must as tartaric acid they calculate it as sulphuric acid. It makes no difference what acid is preferred for comparison as long as it is explained; therefore when I say that a must contains 6·5 per 1,000 of total acidity, I must say whether the acidity was calculated as tartaric, sulphuric or any other acid. In fact, a total acidity that would be expressed by 6·5 if

calculated as tartaric acid, would be expressed by 4·25 if calculated as sulphuric acid; or, in other words, 4·25 parts of sulphuric acid are as acid as 6·5 parts of tartaric acid. If sample A of Hermitage contains 6·5 of total acidity calculated as tartaric acid, and sample B of Malbeck contains 4·25 per 1,000 of total acidity calculated as sulphuric acid, the acidity of those two samples is equal.

The importance of a suitable proportion of fixed acidity in must has been settled beyond any possible discussion by a long practice which followed the experiments scientifically conducted at Government laboratories and experimental cellars in different vine-growing districts in the south of Europe.

The total acidity of a must should not be below 7 per 1,000 calculated as tartaric acid. From numerous tests which I had the opportunity to make for the last nine vintages in this State, I am enabled to say that with very few exceptions musts in New South Wales all fall short of that proportion, and to increase the acidity of grape-juice is a practice that I should like to see becoming pretty general in this country.

A convenient acidity ensures by far a better fermentation, and musts will ferment out until they are dry, which is a great advantage in making clarets, Hocks and Chablis types. Many alterations to which wines are so easily subject and are caused by bacterial life are thus avoided, and the colour, brightness, and palatable characters of the wines are very much improved. Wines deficient in fixed acids never develop a really fine bouquet. The acids which are employed for raising the total acidity of a must are either the tartaric or the citric acid.

Tartaric acid is a natural constituent of the must, therefore its increase within the proper limit does not constitute an adulteration. Citric acid can hardly be considered a natural ingredient of the grape-juice, although traces of it have been found by some analyst and in some grapes. It is also contained in strawberries, gooseberries, raspberries, mulberries, cherries, medlars, &c., and is the principal acid of citrus fruit. The legislation against the adulteration of wines of some European countries does not mention citric acid as a licit substance in the treatment of musts or wines and on that account it was also excluded from the Act in force in New South Wales, although the writer realises the great advantages that citric has over tartaric acid.

I shall not go into details about the comparative advantages of citric acid. In the Act there is no provision absolute or contingent for its use, and the matter may end there. Rather let us see how the kindred acid, the tartaric, must be used.

Experiments made several years ago by Signor Chiaromonte at Barletta, and confirmed later by Signor Pagnotta and other Italian œnologists, go to show that when tartaric acid is dissolved in the must it is found that after fermentation a portion of the acid so added does not remain in solution, but combines with potash and forms cream of tartar, which sinks with the lees and is lost as far as its effect on the wine. If tartaric acid is added to the must and this is fermented without skin, as is the case for white wines, only 47 per cent. of the quantity dissolved is afterwards found in the wine, and if

it is dissolved in the juice and this is fermented with the skins, then only 25 per cent. remains in the wine; that is to say that in the first case only half is utilised and in the second but one-fourth.

Supposing that we test the fixed acidity of a must and find it to be 6 per 1,000, calculated as tartaric acid. Such proportion being low it should be raised to 7 per 1,000, thus, in view of the experiments, the deficiency is made up by adding two parts of tartaric acid in every 1,000 of must if it is intended to ferment it without the skins and four parts if it will ferment with the skins, viz., 2 lb. of acid for every 100 gallons of must without skins and 4 lb. of same for every 100 gallons to which the skins will be added. The relative proportion is the same for quantities over 100 gallons.

Tartaric acid can be bought in Sydney. It should be pure, free of lead; it costs about 1s. a lb. In making the above calculations I purposely chose a must with 6 per 1,000 of fixed acidity, because within a fraction more or less it is the proportion generally found in the grape-juice of this State, therefore the quantities calculated to meet this case can be adopted in practice by the great majority. The acid in question is readily soluble in must; it can be dissolved, first in three or four buckets of must (wooden buckets to be preferred), and then this is well mixed with the bulk.

It might be said that by making an early vintage and picking grapes before they are too ripe the necessity of adding tartaric acid may be avoided. So it may, but where the vineyard is a large one and the vintage takes two or three weeks, it will be found that the grapes that are picked last will yield a juice very deficient in acids.

How to Control the Temperature during Fermentation—a substitute to Fumes of Sulphur.

One of the treatments to which grape-must is submitted and has been adopted for the last two or three vintages by a great number of winemakers in the more advanced districts of Europe, is the addition of a certain proportion of potassium metabisulphite. In the temperate zones where the visitation of parasites and often long periods of wet weather spoil the grape crop and in the more congenial climate of the south, in Algeria and Tunisie where, unless musts by some means or other are cooled down the wine is sure to be spoiled, the practice of mixing the above-mentioned substance with the must before fermentation is finding increasing favour.

Italian and French literature on the subject is a chorus of eulogies, and the remarkably good results obtained by the judicious application of the system are superior to those obtained by the cooling of the fermenting juice with the various machines and devices now more or less in vogue in those vine-growing districts where vintage takes place during hot weather. In previous articles in the *Gazette* I had an opportunity to deal at length on the relation between temperature and fermentation and the deterioration which the wine is subject to if during fermentation the heat developed in the vat rises beyond the limit *optimum* for the normal physiologic activity of the alcoholic yeast. Premature conclusions with reference to the respective action

of the congery of micro-organisms budding forth in the juice of grapes have assigned a distinct and independent action to a number of them, which bacteriologists have rather too hurriedly classified.

Duclaux, late Director of the Pasteur Institute, points out that the various kinds of yeast have been by previous micro-biologists divided into so many races; boundaries have been marked between them in many instances misleading. He recognises the impossibility at the present time of a systematic division of yeast races with well-defined characteristics. The further study of microbial life in the grape-juice and wine has shown that the characters by which the various kinds of yeast and microbes had been differentiated become more confused and complicated the closer their study. It was believed, for instance, that the agents of alcoholic, lactic, butyric, mannitic, and other fermentations had nothing in common and that they were the respective and only agents to which was due the formation of alcohol, lactic acid, butyric acid, mannite, &c. At present, on the contrary, a large number of microbes are known that are agents for the production of alcohol, and of many other substances, among which may be mentioned acetic, lactic, butyric, carbonic acid, either singly or differently associated. When, therefore, the alcoholic, acetic, lactic, butyric, &c., ferments are mentioned, they must be considered as the principal, but not the sole agents of alcoholic, acetic, lactic, butyric, &c., fermentation.

The principle is still maintained that ferment secretes a substance, the diastase, which acts chemically on the sugar. Further still, Duclaux is of opinion that the alcoholic yeast is apt in special conditions of environment to produce acetic and other acids and aldehydes, therefore it may secrete many special diastases other than the alcoholic one just as there are secondary substances produced during fermentation. In other words, the alcoholic yeast for instance may secrete, besides the alcoholic diastase a different one responsible for the production of acetic acid, another for that of butyric acid, one again for that of lactic acid, &c. In consequence of this the idea of the fermenting power of a yeast which was represented by the quantity of alcohol produced by a given weight of yeast-cell in a unit of time, must be corrected. Not the alcohol alone should be taken into account, but with it the total also of other substances formed in the fermented liquid which derived from the same yeast.

All efforts in wine-making should be directed to creating an environment to the yeast-cells in which they will act exclusively as alcoholic ferment. A must not overcharged with albuminoid substances, having a fair proportion of fixed acidity and sugar, cannot fail to give a fair wine even if the grapes are not of the finest varieties or even if they were grown in soils not quite suitable. This result will be attained, provided that fermentation takes place at relatively low temperature which should not rise, when at its highest, over 92° Fah.

In previous articles I explained and illustrated several ways for keeping the temperature in the fermenting vat within the proper limits. I shall resume them here and then I shall write more fully about the use of

potassium metabisulphite as a more expeditive and more effective means to the same end.

1. Gather the grapes early in the morning and crush them soon afterwards; or gather them in the evening, spread them on a suitable cement floor in a well-ventilated place and crush them early the following morning. I know of a vigneron in the south of Italy who makes it a practice to take advantage of moonlight nights for grape picking.
2. If grapes are gathered during the hottest hours, they may be spread on a proper floor and sprinkled with water. If the room is well-ventilated the quick evaporation of the water will cool the grapes effectively.
3. Keep the windows of the fermenting-house closed in daytime and open them at night.
4. Never use false heads in the fermenting vats with the purpose of keeping the husks submerged.
5. Prefer always small-sized vats. Cement vats with thin walls are much more suitable than wooden vats.
6. If loads of hot grapes come to the crusher and cannot be by any other means cooled down, they may be crushed and the juice distributed in several vats so as to fill only a third of their capacity. When the morning loads come with the cooler fruit the juice is divided among these vats.
7. If the temperature of a vat rapidly increases and there is the certainty in view that the heat will rise beyond 92° Fah., the bulk of juice and skins may be proportionately split and placed in three or four vats and cool must mixed with each lot. No risk whatsoever is run by mixing musts at different fermenting stage. The result is beneficial in every way.
8. Adapt within the vat coils of piping through which a supply of cool water is kept running, or use one of the various coolers now on the market, like that suggested by Roos and named after him, or the other made by Guilleband, which is much the same.
9. Strong aeration of the must by a contrivance that will work like a churn, giving the propeller a speed of 500 or 600 revolutions per minute.
10. Wine-makers who are in a large way of business, or large co-operative wineries might find it convenient to employ refrigerating machines, of which there are various kinds, like that of Linden, in which the refrigeration is obtained through the evaporation of ammonia, that of Riedinger, and the other of Pictet in which carbonic acid and sulphurous acid are respectively used as cooling agents.

Everything considered, most of the above-mentioned systems are either beyond the reach of the average wine-maker, or very inconvenient, entailing a loss of time, the employment of extra hands and the necessity of the erection of special cellars and shades, or the setting aside of a number of wooden vats, still good and serviceable.

Potassium metabisulphite.

It is generally known that the fumes of sulphur act as a check of all bacterial life, and it is for this faculty that such fumes are largely used in cellar work and in the treatment of wines. Fumes of sulphur are nothing else than sulphurous acid. Potassium metabisulphite is a compound of sulphurous acid with potassium. It is in very white crystals, soluble in water, must, or wine, specially if the solvent is warmed. Potassium metabisulphite is not a very stable salt; therefore a weak acid solution like that of must or wine will decompose it and the sulphurous acid contained in it is set free. When the metabisulphite is dissolved in the grape-juice the acids of the latter will act on it, split it up, and give off free sulphurous acid, which remains dissolved in the liquid and checks its fermentation.

Sulphite, pirosulphites, and metabisulphites may be considered as nothing else but fumes of sulphur in a condensed form. Their only fault is their name, too scientifically chemical, on reading which the layman's eyes see the ghost of adulteration.

Yeast germs are abundant in the grape-juice and if the temperature of the liquid is about 60° Fah., the germs quickly begin to bud and multiply. When the temperature increases within certain limits, also the prolificity of the yeast-cells increases and it may be safely said that it is at its highest between 78° and 85° Fah.

The greater the number of yeast-cells the shorter is the time required for the splitting up of the unit quantity of sugar. The disappearance of sugar in a fermenting must is a chemical phenomenon. The place of sugar is taken by alcohol, carbonic acid, glycerine and succinic acid, which are the normal products of alcoholic fermentation. All chemical phenomena produce heat. The more rapid is the splitting up of the sugar, the greater the quantity of heat accumulating. It is not that a rapid fermentation produces a larger quantity of heat than a slower one; it is only that the same number of calories, instead of being produced, say in six days, are produced in two. In the former case a great deal of it disperses and the temperature of the liquid does not rise much higher than the initial degree; in the second, the dispersion is much less, and there is in consequence accumulation and a sudden rise over and above the initial temperature. The yeast-cells then find a new environment, within which, besides yielding the normal ingredients, produce other substances tainting the wine. A portion of the sugar that should have yielded alcohol is utilised by the yeast to produce these other substances which make wine unpalatable. If the multiplication of the yeast-cells is checked by some means, the splitting up of the sugar is made more gradual, fermentation will take longer to accomplish, but the sudden rise of temperature will be avoided.

The idea of using sulphurous acid to check the yeast with the view of, keeping the must within the limits of temperature most suitable for a pure alcoholic fermentation is not four or five years old, viz., does not date since it began to be more widely known. The idea originated from Signor Czeppel manager of the experimental wine cellar attached to the Viticultural College

of Catania, Sicily. Czeppel in 1890 added calcium sulphite at the rate of 30 grains to every 100 gallons of must and followed the progress of fermentation of this and of an equal quantity of grape-juice of the same variety as term of comparison. After ten days the sugar in the first must had totally disappeared and the wine was quite dry, while the witness was still sweet. In the former the temperature reached 89°; in the latter it went up to 96° Fah. In 1891 he repeated the experiment with the same success, and concluded that with 90 grains of calcium sulphite in every 100 gallons of must a decrease of from 12° to 14° Fah. can be obtained. He also suggested that the dose of calcium sulphite should be added in four times, a quarter each time, at the interval of twelve hours. Here we have then the method in all its details as is advocated to-day, the only difference being that instead of calcium sulphite the metabisulphite of potassium is preferred.

During the same vintage of 1891 Signor Chiaromonte, of the Government Experimental Cellar of Barletta, in Italy, experimented the influence of calcium sulphite on fermentation, and concluded that to check fermentation, and consequently reduce the temperature effectively, a dose of 1½ oz. was required for every 100 gallons of must. He found also that very small quantities of sulphite of calcium were apt to stimulate rather than to check the yeast-cells. This is quite in accordance with the results obtained by several scientists relative to the stimulating effect of small doses of antiseptic substances on the yeast and most bacteria. Signor Chiaromonte in concluding the report of his experiments was not very enthusiastic over the system and the chief objection to it he saw in the neutralisation of the fixed acidity caused by the calcium contained in the calcium sulphite.

It seems to me that the quantity of fixed acidity that may be neutralised by the calcium contained in 1½ oz. of sulphite added in 100 gallons of must is very small, especially when it is considered that the addition of tartaric acid in musts deficient in fixed acidity is quite licit and beneficial, and any slight loss in the fixed acidity through the action of the calcium sulphite can be made good.

The question remained at that stage for the following seven or eight years, until it was taken up again four or five years ago and the potassium metabisulphite was and is still advocated instead of calcium sulphite.

The advantage of the former over the latter is that its action is quicker, and can set free a larger proportion of sulphurous acid. 1 oz. of metabisulphite of potassium yields a little over ½ oz. of sulphurous acid.

How to use Potassium Metabisulphite to control the Temperature of Fermentation.

A suitable proportion is 8 oz. of metabisulphite for every ton of must and skins. In the case of white musts which are fermented without it the same dose of 8 oz. will suffice for the quantity of juice yielded by 1½ tons of grapes.

Supposing I have a fermenting vat in which I can place the juice and skins of 2 tons of grapes, 16 oz. of metabisulphite will be required. The mixing of this dose should not be done in one act. The 16 oz. of crystals are divided into four lots each of 4 oz.

The first lot of 4 oz. is put in a wooden bucket and a pint of boiling water is poured on it while stirring energetically. As soon as it is dissolved the solution is mixed with the bulk of must and skins and is thoroughly worked in with a long stick, or better still the solution of metabisulphite is poured when half the bulk of juice and skins is in the vat and on the top of it the second half is then added. Hardly any delay beyond the usual will occur before fermentation will start. The husks will gradually gather to the surface to form the cap and everything will proceed in the ordinary way to which the wine-maker is accustomed. A thermometer as well as a saccharometer should be kept handy.

The temperature of the bulk having been taken and recorded at the moment when the first dose of metabisulphite was mixed, its rising should be watched. About three times a day the thermometer should be plunged, so as to place its bulb just underneath the cap. There the heat is always highest, because of the skins on which the greatest number of yeast-cells are to be found. A glass cylinder is also filled with the fermenting liquid and the quantity of sugar contained is recorded for every test. By comparing the temperature and the percentage of sugar with the temperature and percentage of sugar recorded the last time, we can form an idea of how fermentation proceeds. If the sugar disappears rapidly and the temperature rises quickly the second lot of 4 oz. of metabisulphite is dissolved in another pint of water and put in a tub. About one-fifth of the bulk of the fermenting must is withdrawn from the vat and is let fall in this tub, while with a pump it is sucked from the tub and spread over the cap. I mentioned that it is just below the cap that the temperature is always highest, therefore the portion of the must conveying the second dose of metabisulphite will act directly on the top layers of the bulk to check the too great activity of the yeast-cells. Four or five hours are allowed to elapse and the temperature is taken again, as said before, together with a sample of the must of which the quantity of sugar is noted. If the temperature is not lower it should be the same as that of the previous reading or thereabout. The percentage of sugar will naturally show a decrease, because fermentation is only checked, but not stopped. It might be however, that in spite of the second dose, the fermentation continues to be very tumultuous and the temperature goes on rising. If such be the case the third lot of 4 oz. is added at once in the same manner as already explained.

Fermentation will receive a check this time, but the wine-maker should keep taking the thermometer readings every couple of hours, and when the glass goes up quickly the last lot of 4 oz. of metabisulphite is added. It might occur also that the last 4 oz. will not be required.

This system makes fermentation much longer and the vignerons of this State accustomed to seeing a must fermenting out quite dry, often in forty-eight hours, might find that its application will mean a larger number of fermenting vessels. That is so, because by subduing the yeast's activity the time required for the splitting up of the unit of sugar will be longer. I must remind them that fermentations, which take only two or three days to accomplish, are those that as a rule give wine of inferior quality, if not altogether unsound.

A must in which metabisulphite has been mixed will take twice the time to ferment its sugar, therefore those who will adopt the system should make provision for a larger number of vats. At the same time, they may be sure that this method of vinification is quite worth the trouble. If the wine-grower should be short of vats he may withdraw the juice before fermentation is quite finished and let the residual sugar ferment in the cask, but before separating the liquid from the skin he should take an average sample and see whether the juice has enough colour.

Once fermentation is completed, or nearly so, the presence of sulphurous acid in the wine is no longer required.

When racking the wine it is let fall in a tub; from this it is pumped into the cask, which requires no sulphurising, aeration being necessary in this case and in every racking that will be done during the year.

MONTHLY WEATHER REPORT.

HAWKESBURY AGRICULTURAL COLLEGE.

SUMMARY for November, 1905.

Air Pressure (Barometer).			Shade Temperature.				Air Moisture Saturation.			Evaporation (from Water Surface).			
Lowest.	Highest.	Mean.	Lowest.	Highest.	Mean.	Mean for 13 years.	Lowest.	Highest.	Mean.	Most in a Day.	Total for Month.	Monthly Mean for 8 years.	% of the year's Evaporation.
29·66 9th.	30·42 15th.	30·008	34·8 1st.	104·9 27th.	69·44	69·18	40 Several days	100 30th.	50	0·377 13th.	in. 6·741	in. 5·495	12¼

Rainfall ..									Total for Month.	Mean rainfall for 13 years.
Dates...	9	17	18	19	20	28	29	30		
Points..	6	1	7	2	4	10	145	335*	510	210

	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
Wind	3	20	1	1	4	7	3	8

Thunderstorms on dates—9.

Greatest daily range of Temperature, 51·3 on 16th.
Extremes of Rainfall in November, 0 340 in 1897; 4·317 in 1893.
Days on which Shade Temperature rose above 90° Fahr.—91·2 on 3rd; 94·4 on 7th; 102 on 8th; 97·4 on 9th; 94·3 on 11th; 96·4 on 12th; 94·5 on 16th; 100·5 on 17th; 94 on 24th; 95·4 on 25th; 99·2 on 26th; 104·9 on 27th.
A frost occurred on Nov 1.
Remarks.—A hot, dry, windy month, beginning with a frost, the first ever recorded here as late as November: all through the month from the 6th the extreme dryness of the spring was intensified. On the 27th occurred the hottest November day recorded here; a southerly broke the heat up. and was succeeded by good rain, which just came in time to prevent the summer crops from being a complete failure.

* These falls are in the ordinary way entered on the day succeeding these dates, consequently this fall would be recorded on December 1, and come in the December results in calculating the monthly rainfall and its means. The dates given for rainfall in the above table being the days on which the rain fell.

CHAS. T. MUSSON,
Observer.

Orchard Notes.

W. J. ALLEN.

JANUARY.

OWING to the cool backward spring this year nearly all fruits are late in ripening, and in many instances early and late apricots, cherries, &c., ripened at about the same time. On a recent visit to Armidale, for the purpose of investigating the nature of a disease which is causing a little trouble in one or two of the cherry orchards situated on heavy soil, I had an opportunity of inspecting several good cherry orchards, among which were those of the Messrs. Geo. and Charles Jackes, who, notwithstanding the unfavourable season, had very fine crops of cherries, which were of excellent size and flavour. The peculiarity which struck me most was to see the Florence and St. Margaret cherries ripening with the Napoleon and other earlier varieties; the trees, too, were bending down with the weight of the fruit they were carrying. I hope to be able to show one of the Florence trees, which was taken with its crop of fruit on, in the next number of the *Agricultural Gazette*.

Plums and apples have set better in many parts of the New England district than in the Southern and Western parts of the State. In these latter parts of the State nectarines are almost a total failure in many places; the peach and plum crops are light, as also some varieties of apples. On the whole, the fruit crop promises to be below the average. The fruits which this year are carrying the best are apricots and grapes. From the information which I have been able to collect, I fancy the jam factories will have some trouble in securing sufficient fruit this year to keep them running full handed throughout the season. Fruit fit for canning and jam making should, therefore, find a ready sale at good prices.

It will soon be time to treat citrus trees infested with scales, and wherever Bordeaux mixture has not been used since last fruit season, fumigation will be found the most reliable means of ridding the trees of these pests; but where the trees have been sprayed with the Bordeaux it will not be safe to fumigate. It will, therefore, be best to give the trees several dressings during the next two months with the resin, soda, and fish oil solution in order to keep the scales in check.

With regard to Fruit Fly, if all fallen and infested fruits were picked up and boiled, we would in this way destroy so many of the larvæ that it would only be a matter of time before this much talked of and destructive pest would be almost wholly eradicated, and, in consequence, the loss of fruit reduced to a minimum.

Peaches fit for canning and drying will ripen this month. For the latter purpose, see that the fruit is thoroughly ripe before picking from the trees. Cut them evenly before placing on the trays, cut side up, then submit them to sulphur fumes for about two hours, after which they may be placed either in the sun or evaporator, as the case may be. As soon as they are sufficiently dry, remove from the trays and place in calico bags, to keep them away from the fruit moth.

In canning, the fruit should be selected and peeled, then packed tightly in the bottle or tin, and a syrup varying in strength from 30 to 40 per cent. sugar should be poured over the fruit, filling to within a quarter of an inch of the top. If tins are used, they should be sealed down, leaving a pinhole in the tops. Exhaust by plunging into boiling water for five minutes, at a temperature of 212 degrees. Remove and solder up the small hole, then plunge into the bath again, and cook for fifteen minutes at a temperature of 212 degrees. A little longer cooking may be necessary if the fruit is hard, or less if it is soft.

If a retort is used, cook for five minutes, at a temperature of 240 degrees. Nectarines and pears do not require cooking so long by two or three minutes in the open bath, and only from three and a half to four and a half minutes in the retort, at a temperature of 240 degrees.

Honey in South Africa.

Mr. Valder, the Government Commercial Agent for New South Wales in South Africa, reports that the Cape Town market is not well supplied with first-class honey, the locally-produced honey being generally of inferior quality, and put up in a very indifferent manner. The imported article is usually obtained in 1-lb. tins, and is also often of poor quality, and as the retail price for same ranges from 1s. to as much as 1s. 6d. per lb. the sale is very small. Mr. Valder sees no reason why a trade in good honey should not be worked up. The quantity of honey imported into South Africa has, during the past five years, varied from 40 up to as much as 80 tons per annum, arriving in about equal quantities through the Cape ports and Durban. Of this, New South Wales has only supplied a very small portion; but provided future shipments are of really first-class quality, Mr. Valder thinks there is a constant demand for a limited quantity of good honey. The supply in the past has been at such high prices, that it practically prohibited the people becoming honey-eaters; but with a good supply at a reasonable price they would, no doubt, soon become consumers on a large scale, and the imports would rapidly increase. In connection with the high retail price, it must be remembered that there is a duty of 2d. per lb. on honey entering South African ports.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

DIRECTIONS FOR THE MONTH OF JANUARY.

WE may expect hot, dry winds this month; but as the season has been remarkably variable up to time of writing, it is quite possible that we may have rain in abundance. If such should be the case, there need be no difficulty in raising all the vegetables required; the main trouble will be in keeping down weeds.

In case of dry weather, deep cultivation and abundance of good dung dug into and thoroughly mixed with the soil, and used as a mulch as well, should do much towards facilitating the production of vegetables of some kind. In out-of-the-way places, away from the haunts of the Chinese gardener, the value of a few vegetables—if only some tomatoes—is almost inestimable, and no doubt anyone determined to do so can, with care and patience, raise something, if every drop of waste water—unused tea, even—be saved for the purpose, and a small wind-break be fixed up as shelter from hot winds.

Speaking about tomatoes, it is probable that the small-fruiting kinds will withstand the effects of dry weather better than the large-fruiting varieties; although the smallest, the "currant" variety, is but a poor growing thing, not worth the growing. The pear-shaped and the bell-shaped are the kinds worth a trial. When planting, be sure to set in a hollow, and not in a bed raised above the surrounding surface, from which any water supplied or rain is sure to run off. With a bed made below the surface every drop will sink in, for it cannot run off. This is an important thing to attend to; and it is really surprising how frequently the mistake is made of adopting the system of raised beds in dry places, both for vegetables and flowers.

Vegetables.

Beans, French or Kidney.—These, probably, will be found difficult to grow wherever the rainfall has been low, for they need a good deal of moisture during their growth; but in moist districts there should be no want of these useful vegetables. Sow according to requirements, once, twice, or oftener, if necessary. All plants which have ceased to produce beans profitably should be removed, and the spaces they occupied made use of for some quite different kind of vegetable, say cabbage, tomato, melon, vegetable-marrow, or anything of a different natural order. If peas follow beans, and then beans again follow the peas, the soil is liable to become "sick" of the same class of plants, and any diseases common to these have splendid opportunities of increasing. It may be as well to mention that tomatoes, egg plants or capsicums had better not follow potatoes, nor potatoes tomatoes, &c., on the same soil; nor should cauliflowers, cabbages, Brussels sprouts, kale, or turnips follow one another, and so on with other vegetables. A little knowledge of botany would be found of much service, either in the garden

or on the farm, and now that horticulture and agriculture is likely to be taught in many of our schools, it would be well for the teachers to give those scholars who receive instruction a grounding in the science.

Beet, Silver.—Although this useful vegetable will grow under adverse conditions, in dry seasons, the results are not satisfactory, for the plant needs a good deal of moisture to enable it to produce succulent leaves. If the weather be favourable, and soil moist, young plants may be set out, if any have been raised for the purpose; or seed may be sown if plants are required.

Cauliflowers may be planted out if good strong little plants are ready; but it is not much use planting if the weather and soil are very dry, that is unless abundance of water is available. A little seed should be sown and well looked after. Get the best seed possible, even though the price may seem high.

Cabbage.—Treat just the same as the above. Both of these vegetables need abundance of manure and abundance of moisture, the evaporation from them being enormous during their growth—far greater than anyone who has not studied the subject could imagine. The manure, although needed in abundance, should not be rank, but should be well rotted, otherwise these and kindred vegetables, such as Brussels sprouts and Savoys, will be rank when cooked.

Celery.—Set out a few plants if any are ready for the purpose, if the rainfall is good, or if a good supply of water, suitable for watering, is available. Sow a little seed for future plantings.

Carrot.—Sow a little seed in drills, and be careful to keep the seedlings well weeded as soon as they come up, and thin them out as soon as they are 2 or 3 inches in height.

Endive.—A little seed may be sown, but this is better suited to cool than hot weather, and it might be as well to await chancing loss of seed for the present.

Turnip.—Seed may be sown in small quantity in drills.

Swede.—Sow a small quantity of seed in drills.

Potato.—A few rows of early potatoes should be planted towards the end of the month. Drain well, dig deep, and apply a good dressing of farmyard manure—if well rotted so much the better. Use medium-sized potatoes free from scab for seed, and plant in rows about 3 ft. to 3 ft. 6 in. apart, setting the potatoes about 1 ft. from each other.

Peas.—If the weather is favourable and the soil is in a good moist condition sow a few rows.

Radish.—Sow a few rows from time to time during the month.

Tomatoes.—Seed may be sown if more plants are required. Young tomatoes may be planted, and old, useless plants may be taken up and destroyed.

Flowers.

January is a trying month for flowers if the season is dry, and unless water can be given rather liberally, probably a good many plants will die away. Some take a rest at times and cast many of their leaves—such as roses. These can be pruned back later on, before the wood-buds start into growth,

and excellent autumn flowers are likely to follow, especially should the autumn or late summer set in. Sunflowers, portulacas, cockscombs, large ornamental-leaved amaranths, globe amaranths, and celosius should grow satisfactorily if there is any rain at all. Dahlias may still be planted, and advanced plants should be tied up to supports as they increase in height. Remove any suckers that may be seen, and only permit each plant to have a single stem. Use water freely should the weather be dry. Chrysanthemums will need a good deal of water also. Zinnias and balsams will probably produce flowers during the month, and perhaps early-planted asters. With any sort of a favourable season for the remainder of the summer, there should be innumerable flowers in any well looked after garden.

The Destruction of Blackberry Briar.

At various times information has been sought from the Department with regard to the destruction of Blackberry Briar in a less laborious way than by digging or chopping out with a mattock. At the Hawkesbury Agricultural College experiments were carried out in the destruction of Prickly Pear by means of a solution of arsenite of soda sprayed on with the orchard spray-pump. A full account of the method appeared in the *Gazette*, January, 1902.

The matter of treating Sweet Briar and Blackberry Briar in a similar way was referred to Mr. F. B. Guthrie, who suggested that the freshly-cut stems of the plants should be dressed with dry powdered arsenite of soda. The correspondent to whom this was suggested, in a report to the Director of Agriculture, states: that "This was only partially successful, owing, perhaps, to powder purchased not being the best kind, being lumpy, and having no means at his disposal to make it fine—a large quantity fell to the ground, refusing to stick to to the ends of the stems—where it did cling it did its work effectually. However, the idea of applying arsenite of soda was made use of by making a solution of arsenic and soda in the proportion of 1 lb. arsenic to 2 lb. washing soda, and mixing them in 5 gallons of boiling water (the water must be boiling while the mixing takes place). This was applied to the roots, after digging round them, so that the liquid would percolate to the roots. This was most effective; the clump of briar is now quite destroyed."

The cost of treating this particular patch, having an area of about 12 square yards, was about 2s. 6d.; it would, therefore, be too costly for large areas, unless a less quantity proved sufficient to kill the plant than was used in the instance above quoted. Arsenite of soda is a very deadly poison, and under ordinary circumstances contact of living plants with very small quantities is sufficient to kill.

In the experiments carried out at the Hawkesbury Agricultural College the cost of arsenite of soda solution worked out at 2d. for 5 gallons. If, then care is taken to apply the solution without waste by means of a spray-pump, the cost should not be beyond a reasonable amount, and would, without doubt, be cheaper than grubbing by hand. A word of caution with regard to stock running in the same paddock is necessary. Owing to the poisonous nature of arsenite of soda, stock should be removed until the brush has been burnt off. By this means any grass that may have been sprayed will have died and will thus be burnt, and the risk of accident from poison reduced to a minimum.

Farm Notes.

HAWKESBURY DISTRICT—JANUARY.

H. W. POTTS.

IN no period of the history of the agricultural development of the Hawkesbury district has the year commenced under more favourable conditions in so far as rapid growth is concerned. The rainfall during the latter part of November and early part of last month was ample. Six inches fell in a few days, and moistened the subsoil freely without undue washing. The natural grasses and herbage are abundant and succulent.

"The busiest time on record," is the announcement of our farm foreman, and all through this month it will be so to keep pace with the demand for suppressing weeds and retaining soil moisture by shallow cultivation.

The autumn crops are practically assured, and the outlook for stock feed for next winter is most promising.

All stock are looking well and responding to the fresh spring of grass.

Maize.—The early crops, despite the check they received before the rain came, are now looking well. The later crops demand constant attention to prevent any suspension of growth. The importance of thorough cultivation is very prominent at present; all successful maize-growers realise this. The aim is to maintain a steady, vigorous, and healthy growth. It is fatal to the development of a fully-matured plant to permit of any check at this stage. The characteristic dark-green coloured foliage, the strong, thick, and sturdy stems, are a sign of desirable conditions. The outcome of all tests in this direction point to shallow cultivation as affording the most suitable stimulus. Avoid disturbing or cutting the roots of the plant; should this happen, then other roots are encouraged to grow, and thus weaken the vitality of the main plant. Three inches is now adopted as the standard depth, although in many cases 4 inches has been found a useful depth. For simply conserving soil moisture, a depth of 2 to 3 inches is sufficient, excepting after heavy rainfall, when the soil is apt to cake hard to a greater depth. The matter of frequency of cultivation necessarily is determined by local conditions of soil and climate. The object is to preserve constantly a loose soil surface to check evaporation and to keep down the growth of weeds. Should we get thunderstorms during the month, follow them with prompt cultivation. Even after the plant has attained a height of 3 feet it is good practice to stir the soil in the middle of the row; for this purpose the single cultivator, with a short whipple-tree, is useful. Sowing throughout in all sections has been delayed this season. The varieties especially suitable for fodder purposes and ensilage may be put in, such as Early Mastodon, Hickory King, and Clarke's Mastodon.

Sorghum.—Early Amber, Planters' Friend, Sorghum Saccharatum, and several of the Imphee varieties may be sown throughout the month both for green feed and ensilage. It must be remembered, however, when the seed germinates, and the plant appears, constant cultivation is more essential with this than with maize. Later on, when the plant has assumed full growth, it is hardier than maize, and resists the early frosts of winter. It is not an uncommon sight to see sorghums fed green to stock in July.

Millets.—The final sowings of Hungarian and white French varieties may be made to advantage.

Potatoes.—As anticipated, the early potato crop is not a success, owing to the dry spring season. The later sown crop, however, is looking better, and promises a satisfactory yield. The ground may be prepared this month for the second crop.

Sweet Potatoes.—Planting may be continued. The earlier crops are not fit to dig yet; they promise a good crop.

Pumpkins, Squashes, and Melons.—These crops will require some attention to keep down the weeds, and also some cultivation throughout the month.

Swedes and Mangolds.—The earliest sowings may be made towards the end of the month, after the soil has been brought into fine tilth.

Clarence River District—January.

T. WALDEN HANMER.

Maize may still be planted this month, although rather late for grain, but no doubt many farmers will avail themselves of the chance provided the weather be favourable, owing to the great scarcity and high prices, due to the exceptional dry weather early in the summer. January is always a good month to sow maize for green fodder for dairy cattle, and few, if any, crops are better for milking cows.

Sorghum.—The varieties of the sorghum family may also be sown for green fodder this month.

Pumpkins and Grammas.—These may also be planted this month, and with favourable weather should yield well.

Potatoes.—The first crop of potatoes in this district, like the early maize, proved an almost total failure, and there was in many places a strong second growth. Farmers desirous of planting a late crop would do well to get land ready for planting at the end of present month or early in February.

Millet for broom-making may be planted this month, but early sowings usually are the best.

Full directions for working this crop have been repeatedly given by various writers in the *Gazette.*

Cattle Cabbage.—This is a very valuable crop for dairy-farmers and one that is seldom, if ever, grown in this part of the State. 1 lb. of seed will furnish plants for an acre. Seed-beds for raising the young plants must be made, and when fit they must be transplanted in a manner similar to the

ordinary garden cabbage, although more room must be allowed for the plants to grow on account of their extra size. The best results will be obtained from rich land which has been well tilled, and the more manure (whether farmyard or artificial) that can be applied the better yield may reasonably be expected. The most common way of feeding them to cows is to cut off close to the ground and throw them out in the paddock, allowing one good-sized cabbage to each cow, provided of course that the cow has other feed. Where cows are stall-fed they can be given them in their mangers or feed-boxes.

Crops for Green Fodder.—Prepare land for sowing wheat, oats, barley, rape, buckwheat, and tares or vetches, so that a succession of green feed may always be at hand.

It will pay any dairy-farmer, large or small, to have crops of green fodder coming on all through the winter.

Vegetable Garden.—Sow French beans. Swede turnips, white turnips, beetroot, cabbage, lettuce, and peas.

Pine-apples and Bananas may be planted this month.

Glen Innes District—January.

R. H. GENNYS.

HARVESTING operations will be fairly well finished by the middle of the month. When these are completed it will be well for farmers who possess sheep—and every holder should, if possible, keep a few—to turn them into the cultivation paddocks to eat off all weeds before they have a chance of seeding; the land will also be much enriched by their manure, and the animals themselves much benefited at a time when grass is often very dry and lacking in nutriment.

For green fodder the following may be sown:- *Maize, Sorghums, Millets.* Sow these thickly. *Barley* may also be sown for green feed.

Swedes and *Turnips* may also be sown this month, also *Beans, Cabbages, Cauliflowers.*

Some *Potatoes* may still be planted if required.

Land may be turned over a first time with advantage this month.

Cultivation of Growing Crops.—This must in all cases be persevered with, where practicable; in crops such as maize, potatoes, &c., the cultivation should get shallower as the plant matures, in order not to cut or injure the roots near the surface, as these are most important. Weeds must be kept down, and the frequent stirring conserves moisture about the roots of the plants. Do not imagine the ground is ever too dry for light cultivation, and, although the dust may be flying all the time, the good that is done at this stage is almost incalculable.

In the *Orchard* keep the cultivator going in order to destroy weeds and keep the moisture about the trees from escaping.

RIVERINA DISTRICT—JANUARY.

G. M. McKEOWN.

ON the completion of harvest it will be found advantageous to turn as many sheep as possible on to the stubbles to clean up as much of the fallen grain as possible. The trampling of the sheep also covers a quantity of the grain with a thin covering of earth, and places it in a position to germinate after a light rainfall, which at times is received at this period in occasional thunderstorms. By the help of sheep, therefore, oats and other grain which might later become a source of trouble may be greatly reduced, and at the same time may be made a source of profit.

Fallowed land should be harrowed, or lightly scarified, to assist it to retain moisture.

As soon as possible after having been well grazed by sheep, stubble land which is to be cropped should be ploughed to place it in a condition to receive and retain moisture to the greatest possible extent. For this purpose the rotary disc-plough will be found the most suitable implement, as it can be used in dry districts such as this much earlier than any other machine.

Rape and Swedes.—Land which has been fallowed should be kept in good condition for sowing Swedes as early as the rainfall will admit, as field crops should be sown at latest in February.

Rape, however, may be sown up to April, but March sowing will be found preferable.

Other land intended for sowing should be prepared as early as possible, so as to admit of early sowing of either crop.

Pumpkins, Squashes, and Melons.—The surface of the land between the plants should be kept lightly stirred to conserve moisture, and where water is available for economical application it should be used in dry parts. Vines should be so trained as to shelter their own roots, and they should not be allowed to straggle at will. Fruitfulness may be improved by pinching back the vines which have a tendency to make a rank straggling growth.

Crown Lands of New South Wales.

THE following areas will be available for selection on and after the dates mentioned :—

H.S. No.	Name of Land District.	Holding, &c.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
			FOR HOMESTEAD SELECTION.					
			acres.		acres.		£ s. d.	1906.
*993	Coonabarabran	....	916	10	40 to 113½	Coonabarabran, ¾ to 2¼.	0 10 0 to 2 9 8	18 Jan.
			FOR SETTLEMENT LEASE.					
S.L. No.			acres.		acres.		£ s. d.	1906.
*822	Gunnedah .	....	.. ...	1	4,860	Tambar Springs, 3; Gunnedah, about 48.	20 5 0	4 Jan.
*823	Walgett .	Mourabie ..	7,937	2	3,015 & 4,922	Walgett, 28 and 32 respectively.	56 10 8 and 92 5 10	11
*824	Narrabri ..	Burren .	15,895a. 2r. 30p.	3	4,798 to 5,791	Narrabri, 64 to 65; Burren Junction, 5 to 10.	89 19 3 to 108 11 8	18 ,,

FOR IMPROVEMENT LEASE.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Upset Annual Rental per Block.	Date of Sale or Tender.
			acres.		acres		£ s. d.	1906.
967	Wyalong .	Kolkibertoo	....	1	16,000	Ungarie, 16; Wyalong, 30.	45 0 0 (Inclusive of use of Crown improvements.)	Sale, 5 Jan.
1,359	Warren	Gillendoon	....	1	1,734	Warren, 3 to 8 ...	10 16 9	5 ,,
1,361 and 1,362	Warren ...	Weelah and Gradgery.	3,507	2	1,340 & 2,167	Warren, 40	16 15 0 and 36 2 4	5 ,,
659, 662 †(681 and 682) †683 and 684	Nyngan	W. Bogan Scrubbed Lands, partly within New Babinda Holding.	27,607	4	4,880 to 9,604	Hermidale, 23 to 28.	10 3 4 to 30 0 3	9 ,,
1,330 and 1,331	Dubbo ...	Ganber, Ganber East	9,940	2	5,000 & 4,940	Cobborah, 4; Dubbo, 36.	7 18 4 and 7 16 5	9 ,,
610	Rylstone .	. ...	....	1	760	Capertee, 6; Torbane, 1½.	6 6 8	9 ,,
1,334 and 1,335	Condobolin	Euglo	5,620	2	5,080 and 540	Condobolin, 30	45 0 0 and 4 0 0	9 ,,
605	Bombala ..	....	... .. .	1	3,190	Bombala, 3¾	18 12 2	15 ,,
613 and 614	Albury	....	1,070	2	630 and 440	Albury, 6½	23 12 6 and 12 16 8	15 ,,
611	Boorowa ..	....	....	1	350	Crookwell, 35	4 7 6	15 ,,
1,363	Coonabarabran.	....	....	1	2,870	Gilgandra, 50 ...	17 18 9	Tender, 15 Jan.

* For original holdings only. † As one block.

For Conditional Purchase.

Land District.	Name of Holding, &c.	Total Area.	Parish.	County.	Price per Acre.	Date available.
		a. r. p.			£ s. d.	1906.
Armidale	Oban and Aberfoyle	895 0 0	Oban	Clarke	1 0 0	8 Feb.
"	....	525 2 0	Hillgrove	Sandon	1 0 0	8 "
"	....	4,200 0 0	Cameron and Baker	Hardinge	1 0 0	15 "
Bathurst	....	420 0 0	Oakley	Bathurst	0 16 8	8 "
"	....	1,540 0 0	Balfour	Westmoreland	0 18 4	8 "
"	....	580 0 0	Adderley	"	1 10 0	8 "
*Bellinger	....	115 0 0	Moonpar and Blicks	Fitzroy	1 10 0	18 Jan.
Boorowa	....	96 0 0	Barnett	King	1 0 0	22 Feb.
Braidwood	....	40 0 0	Jinglemoney	Murray	1 0 0	1 "
*†Carcoar	within Barry Suburban Lands.	120 3 3	Neville	Bathurst	2 10 0	18 Jan.
Casino	within Resumed Area, 375.	13,000 0 0	Barrawonga and Drake.	Richmond	0 15 0	4 "
*Coonamble	....	2,547 2 0	Quonmoona	Leichhardt	1 12 6	18 "
Corowa	Kentucky and Quat Quatta.	1,096, 513¼, and 180¾.	Richmond, Kentucky, &c.	Hume	1 6 8, 2 0 0 and 2 10 0 resp't'vly.	8 Feb
"	....	393 0 0	Kentucky	"	2 0 0	8 "
*Forbes	....	320 0 0	Jemalong	Forbes	2 0 0	1 "
*†Grafton	within Lawrence Population Area	247 0 0	Lawrence	Clarence	1 10 0	4 Jan.
Grafton	....	86 0 0	Gulmarrad	"	1 0 0	22 Feb.
Gundagai	....	116 0 0	Childowla	Buccleugh	0 13 4	4 Jan.
Gunnedah	....	10,125 0 0	Lawson, Trinkey, &c.	Pottinger	0 5 0	8 Feb.
*† "	within Gunnedah Population Area	24 3 20	Gunnedah	"	12 10 0	4 Jan.
*Lismore	....	91 2 0	Dunoon	Rous	3 0 0	22 Feb.
* "	....	478 3 0	Nimbin	"	2 0 0	11 Jan.
Lithgow	....	555 0 0	Hartley	Cook	1 0 0	15 Feb.
Mudgee	....	2,320 0 0	Botobolar and Price	Phillip	0 10 0	1 "
Rylstone	....	390 0 0	Goongal	Roxburgh	0 16 8	1 "
"	....	280 0 0	"	"	1 0 0	1 "
Taree	....	285 0 0	Lansdowne	Macquarie	1 0 0	1 "
Tenterfield	....	65 0 0	Timbarra	Clive	1 0 0	1 "
*Wagga Wagga	Borambola	455½, 227½, and 227½.	Cunningdroo	Wynyard	2 0 0, 2 10 0 and 3 0 0 resp't'vly.	8 "
Warialda	....	220 0 0	Hadleigh	Burnett	1 0 0	15 "

* For original holdings only. † Also set apart as special area.

Conditional Purchase Lease.

Land District.	Holding, &c.	Total Area.	No of Blocks.	Parish.	County.	Annual rent.	Date available.
Urana	Noweronie.	acres. 10,880	17 blocks of 640a. each	Palmer and Boreegerry.	Urana	2½ per cent of capital values, which range from £1 15s. to £2 5s. per acre.	1 Feb., 1906.

Special Areas.

Grafton Land District, within the Lawrence Population Area, 247 acres, in parish Lawrence, county Clarence; maximum and minimum area, 247 acres; price, £1 10s. per acre. Available for original applications only on 4th January, 1906. (Also set apart as Original Conditional Purchase.)

Gunnedah Land District, within the Gunnedah Population Area, 24 acres 3 roods 20 perches, in parish Gunnedah, county Pottinger; maximum area, 7 acres 3 roods 6 perches; minimum area, 5 acres; price, £12 10s. per acre. Available for original applications only on 4th January, 1906. (Also set apart as Original Conditional Purchase.)

Carcoar Land District, within the suburban boundaries of Barry, 120 acres 3 roods 3 perches, in parish Neville, county Bathurst; maximum area, 7 acres 0 roods 24 perches; minimum area, 1 acre 2 roods 1 perch; price, £2 10s. per acre. Available for original applications only on 18th January, 1906.

AGRICULTURAL SOCIETIES' SHOWS.

1906.

Society.	Secretary.	Date.
Albion Park A., H., and I. Society	Henry Fryer	Jan. 17, 18
Gosford A. and H. Association	W. E. Kirkness	„ 26, 27
Kiama Agricultural Association	Jas. Somerville	„ 26, 27
Berry Agricultural Association	A. T. Colley	Jan. 31, Feb. 1, 2
Alstonville Agricultural Society	J. C. Foster	Feb. 7, 8
Central Cumberland A. and H. Association, Dural	H. A. Best	„ 7, 8
Moruya A. and P. Society	John Jeffery	„ 7, 8
Wollongong A., H., and I. Association (Wollongong)	J. A. Beatson	„ 8, 9, 10
Manning River A. and H. Association	S. Whitehead	„ 15, 16
Guyra P., A., and H. Association	H. W. Vincent	„ 21, 22
Lithgow A., H., and Produce Society	H. N. Jolliffe	„ 21, 22
Ulladulla Agricultural Association	C. A. Buchan	„ 21, 22
Liverpool A., H., and A. Society	P. A. Shepherd	„ 28, Mar. 1
Gunning P., A., and H. Society	Ernest E. Morgan	Mar. 1, 2
Robertson A. and H. Society	R. G. Ferguson	„ 1, 2
Campbelltown A., H., and I. Society	A. R. Payten	„ 6, 7
Tenterfield Intercolonial P., A., and Mining Association	F. W. Hoskin	„ 6, 7, 8
Bega A., P., and H. Society	John Underhill	„ 7, 8
Walcha P. and A. Association	S. Hargrave	„ 7, 8
Macleay A., H., and I. Association	E. Weeks	„ 7, 8, 9
Fair days	....	„ 9, 10
Narrabri P., A., and H. Association	J. McCutcheon	„ 7, 8, 9
Nepean District A., H., and I. Society, Penrith	E. K. Waldron	„ 8, 9
Berrima A., H., and I. Association (Moss Vale)	James Yeo	„ 8, 9, 10
Bombala Exhibition Society	W. G. Tweedie	„ 13, 14
Cumnock I., A., and H. Association	W. L. Ross	„ 14
The P. and A. Association of Central New England, Glen Innes	Geo. A. Priest	„ 13, 14, 15
Clarence P. and A. Society, Grafton	T. T. Bawden	„ 14, 15
Camden A., H., and I. Association	A. Thompson	„ 14, 15, 16
Oberon A., H., and P. Association	W. Minehan	„ 15, 16
Newcastle and District A., H., and I. Association	Owen Gilbert	„ 15, 16, 17
Lower Clarence Agricultural Society, Maclean	George Davis	„ 20, 21
Cobargo A., P., and H. Society	T. Kennedy	„ 21, 22
Gundagai P. and A. Society	A. Elworthy	„ 21, 22
Blayney A. and P. Association	H. R. Woolley	„ 21, 22
Crookwell A., P., and H. Association	C. T. Clifton	„ 22, 23
Tamworth Agricultural Association	J. R. Wood	„ 27, 28, 29
Molong P. and A. Association	C. J. V. Leathem	„ 28
Durham A. and H. Association, Dungog	C. E. Grant	„ 28, 29
Mudgee Agricultural Society	J. M. Cox	„ 28, 29, 30
Cooma P. and A. Association	C. J. Walmsley	April 4, 5
Bathurst A., H., and P. Association	W. G. Thompson	„ 4, 5, 6
Warialda P. and H. Association	W. B. Geddes	„ 4, 5, 6
Richmond River A., H., and P. Association (Casino)	E. J. Robinson	„ 5, 6
Hunter River A. and H. Association (West Maitland)	C. J. H. King	„ 24, 25, 26, 27, 28
Orange A. and P. Association	W. Tanner	„ 25, 26, 27
Wellington P. A., and H. Society	A. E. Rotton	May 1, 2, 3
Upper Manning A. and H. Association	Edw. Rye	„ 3, 4
Moree P. and A. Society	S. L. Cohen	„ 8, 9, 10
National A. and I. Association of Queensland	....	Aug. 7, 8, 9, 10, 11
Murrumbidgee P. and A.	A. F. D. White	„ 22, 23
Junee P., A., and I. Association	T. C. Humphrys	Sept. 5, 6
Young P. and A. Association	Geo. S. Whiteman	„ 12, 13
Yass P. and A. Society	W. Thomson	„ 26, 27

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Fencing.

GEO. L. SUTTON,
Cowra Experimental Farm.

Experimental Fences.

THE decreasing supply, and consequently the increasing cost, of timber for fencing is gradually forcing landholders to consider how little can be used in the construction of an efficient fence. Metal, *i.e.*, fencing wire, has almost entirely replaced the rails which at one time were considered necessary to make a fence stock-proof. We, however, still find that timber is the cheapest material for fence posts, though the supply available is becoming scarcer each year, and it is possible that in the future it may be necessary to use posts made of iron or concrete. In either case, it is important that we should have information which will enable us to determine how few posts can be used in the construction of an efficient and durable stock-proof fence.

An essential feature of a rail fence is a comparatively short panel, but now that wire is, in the majority of cases, taking the place of the rail, it is questionable whether as many posts are now necessary as was the case when rails were used. That all are not agreed on this point is patent to the most casual observer in a district where wire fences are common. Scattered throughout the country can be seen fences apparently equally efficient, some of which have as many as 880 posts per mile, whilst others are constructed with as few as 160 per mile. In the latter class, cheaper droppers have been substituted for posts.

The erection of subdivision fences at the Cowra Farm was considered an opportune time to obtain information on the points referred to, and to enable those interested to determine-

1. Whether a fence constructed with posts and droppers is as efficient and durable as one constructed entirely with posts.
2. The minimum number of posts required in the construction of an efficient and durable fence when droppers are used; and
3. The character of the dropper required for best results.

Different patterns of fencing were therefore included in the tence which surrounds the cultivation area. Each portion under trial is $7\frac{1}{2}$ chains long (1) strain). The experiment with the fences is divided into two sections, particulars of which are as follows:—

In section I, which deals with the number of posts necessary for efficiency—

Pattern A	has the posts	8 ft. 3 in.	apart	(640 per mile).	
„ B	„	16 ft. 6 in.	„	(320 „),	1 dropper between the posts.
„ C	„	22 ft. 0 in.	„	(240 „),	2 droppers between the posts.
„ D	„	33 ft. 0 in.	„	(160 „),	3 „ „

In section II, which aims at determining the most suitable dropper to use, the posts are 33 feet apart, with three droppers between the posts. Fig. 1.

Pattern D has wooden droppers, *i.e.*, rigid droppers.
,, E has plain ("Anchor") No. 6 B.W.G. wire droppers.
,, F has crimped ("Cyclone") No. 6 B.W.G. wire droppers.

As metal is admittedly more durable than wood, an endeavour was made to obtain a suitable rigid metal dropper, but without success. There is no doubt that should a demand for such a dropper arise, it will be catered for by our manufacturers who, however, will do well to remember that, with our present materials and methods, a necessary requirement of a suitable dropper

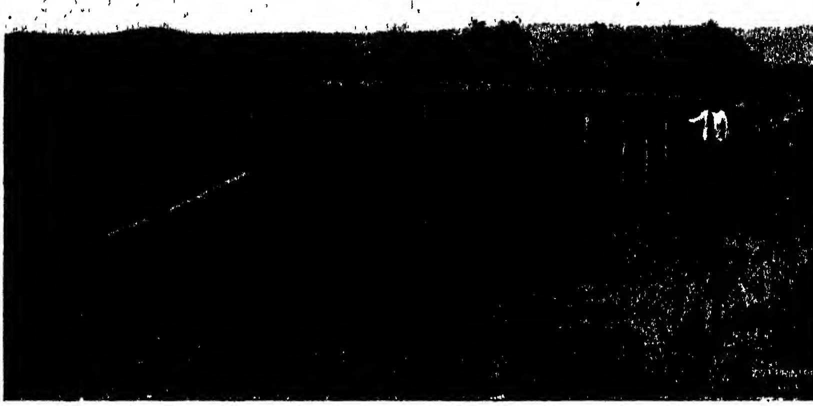


Fig. 1.—A wire-netted boundary or subdivision fence; two posts and six droppers per chain Cost, £68 18s. 3d per mile.

is that when fixed to the wires it will not interfere with that periodical straining which is necessary for the proper maintenance of fences in this State.

The different fences were erected by contract according to the following specification, which was designed to meet the requirements of a general purpose fence, *i e.*, one that would be sufficient to control the movements of horses, cattle, sheep, and rabbits.

Wire Fence, Netted—Specification.

All fencing is to be on and in proper line. The posts when erected are to be straight, uniform, and upright. The split posts are to be in line along the tops, and are not to follow the lesser irregularities of the ground.

Timber.—White and yellow box may be used in the construction of the fence.

All timber is to be taken from large trees. It is to be thoroughly sound, free from splinters and other defects, barked, and straight. All measurements specified are to be taken to mean at the smallest dimensions.

Posts.—All posts are to be sawn square on top, and when erected are to have the earth placed properly around them and well rammed.

The distance between posts will be 8 ft. 3 in., 16 ft. 6 in., 22 feet, 33 feet, as required.

All posts are to be bored properly with ⅜ inch augur holes, as required for the proper placing and spacing of the wires.

Split posts are to be 6 ft. 3 in. long, and to have mean dimensions which range between 7 inches wide by 5 inches thick, and 8 inches wide by 4 inches thick. Centres are to be backed out to within 24 inches of the large end. No face is to be less than 4 inches, and one edge is to be rough-dressed.

Split posts are to be placed in the ground to a depth of 24 inches.

Round posts—*Corner* posts are to be 8 feet long, not less that 12 inches in diameter, and are to be placed 3 ft. 6 in. in the ground.

Straining posts are to be 7 ft. 6 in. long, not less than 10 inches in diameter, and are to be placed 3 feet in the ground. Straining posts are to be erected at distances of about 7½ chains throughout the fence.

Gate posts are to be 8 ft. 9 in. long, to be placed 4 feet in the ground in a direct line with the fence. They are to be not less that 15 inches in diameter.

The tops of gate-posts in each gateway are to be level.

On sloping ground the post on the high side of the gateway is to be 4 ft. 9 in. out of the ground.

Permanent struts are to be placed at all angles and corners of fences and at every second straining-post. They are to be firmly mortised into the posts 22 inches from the top, and are to be firmly butted against the adjoining post or against a short post placed in the ground to a depth of 2 feet, and situated at least 10 feet away from the bottom of the post which they are supporting. Struts are to be not less than 3 inches in diameter.

A quite common defect in the construction of a fence is that of placing the strut too near the top of the post, and consequently at too great an angle

Fig. 2.—An improperly-stayed corner-post. Note the stones piled against the post in a vain endeavour to keep it in the ground

with the line of fence, the result is that when the wires are strained the post is pulled out of the ground. In order to prevent this happening, various plans are tried, the least effectual of which is that of weighting the post as shown in the illustration (Fig. 2). Placed as the strut is in the illustration it is practically doing no good, as can be seen.

Another and more effectual method adopted by some is to place two long struts, one on each side of the wires. This is unnecessarily cumbersome and costly, when the same result can be obtained by placing the end of the single strut lower down on the post, but not lower than halfway. The longer the strut the better it will do the work it is intended to do.

Gateways.—Four gateways are to be placed where directed. Gateways are to be 15 ft. 6 in. from gate-post to gate-post; the fence posts nearest gateway are to be similar to corner posts.

Between the gate-posts a sill, 10 inches in diameter, and flattened to 6 inches at the small end, is to be firmly bedded. The flat face is to be level, and on a level with the ground on the high side of the gateway.

Droppers.—Between the posts, one, two, or three droppers, as required, are to be placed equidistant from the posts and from each other.

The *wooden* droppers, 2 in. x 1 in. hardwood, are to be secured to the plain wires with staples, which pass over the wire through a hole in the dropper, and are then clinched on the opposite side of the dropper; they are to be tied to the barbed wire with No. 12 galvanized tying wire, which is to pass through a hole in the batten about 1½ inches from the top of it.

The *metal* droppers are to be secured to the wires with the loops and clamps specially designed for the purpose.

Wires.—The fence is to contain five wires, including one galvanized barbed wire No. 12 B.W.G., firmly secured to the top of the posts with No. 12 galvanized tying wire, which is to pass through a hole in the post about 2 inches from the top.

The other wires are to be four No. 8 steel galvanized wires, with the following spacings from the ground; 12 inches, 24 inches, 36 inches, 43 inches, and 51 inches.

All wires are to be thoroughly strained and secured in position.

Netting.—A selected brand of netting, 17 gauge, 42 inches wide x 1½ inch mesh, is to be erected, so as to have the straight selvedge at the top. The netting is to be properly strained in an approved manner. A portion of the netting is to be placed, without bending, under ground (in a suitable trench, previously dug the required depth, *i.e.*, 6 inches), so that the netting can be securely fastened to, and in line with, the third wire from the ground.

The netting is to be secured to the top and bottom wires with galvanized netting clips. To the top wire with 24 clips, and to the bottom wire with 16 clips to the chain.

All work is to be finished in a workmanlike manner, and to the satisfaction of the officer in charge of the work.

Though the fences, as erected, have proved very satisfactory, yet two slight alterations would, in my opinion, improve them. The first alteration would be to adopt the plan which Mr. P. Squire has introduced on his property at "Yarra," Cowra. It consists in running the plain wires on the outside edges of the posts, instead of through a hole bored in the post, and some distance from the edge. The plain wire is secured in position by means of tying wire run through a hole bored about 2 inches from the edge of the post. One advantage of this method is that it enables the netting to be strained much tighter, and as flat as a board. The appearance of the fence is thereby greatly improved. The extent of the improvement may be judged from a

comparison of Fig. 3 and Fig. 4, the latter being an illustration of the netting erected according to Mr. Squire's method, and the former an illustration of the

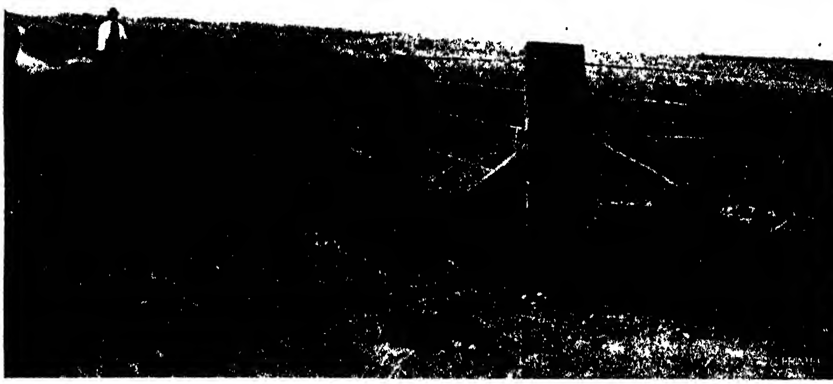


Fig. 3.—A corner-post properly strutted. A wire-netted boundary or subdivision fence; eight posts per chain. Cost, £79 4s. 6d

netting erected in the customary way, and as directed in the specification. Another advantage, and not a slight one in a district where bush fires are prevalent, is that a burnt or injured post can be replaced without in any way

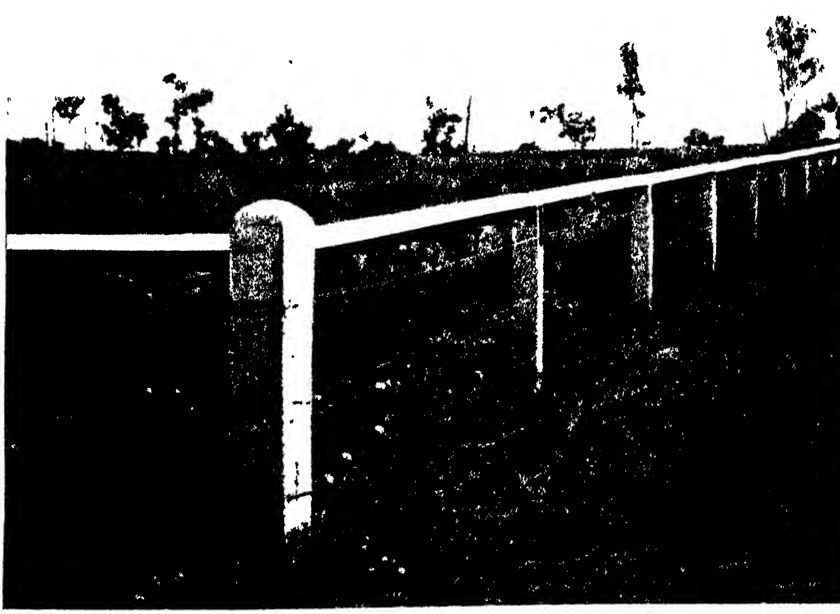


Fig. 4.—A homestead fence. The wires do not run through, but are tied on the outside edge of the posts. Cost per panel (9 feet), 9s.

interfering with other portions of the fence. The cost of fixing the wires as suggested is slightly, but very slightly, greater than the customary way.

The second alteration would be to change the relative positions of the barbed wire and the fourth plain wire, so as to have the plain wire on top and the barbed wire in the position now occupied by the plain one. The object of the barbed wire is to deter horses and cattle from feeding over or through the fence, and thus injuring it. It is noticed that cattle endeavour to feed through the fence just over the top of the netting. By placing the barbed wire in the position indicated, it would still prevent stock feeding over the fence, and would more effectually prevent cattle feeding through the fence.

The cost of erecting the different patterns of fence will be seen from the following statement, in which, for the purpose of easy comparison, the expenditure for each pattern is given at a rate per mile, which has been computed from the actual costs.

EXPERIMENTAL FENCES—Cost of Construction per Mile.

Material and Labour.	Pattern A.		Pattern B.		Pattern C.		Pattern D.		Pattern E.		Pattern F.	
	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount
		£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.
Wire, plain, galvanized, steel 8 B.W.G.	14 cwt	10 3 0	14 cwt.	10 3 0	14 cwt.	10 3 0	14 cwt	10 3 0	14 cwt	10 3 0	14 cwt.	10 3 0
Wire, barb, galvanized, 12 B.W.G.	4 cwt.	3 14 0	4 cwt	3 14 0	4 cwt.	3 14 0	4 cwt.	3 14 0	4 cwt	3 14 0	4 cwt.	3 14 0
Wire netting ..	1 mile	29 15 0	1 mile	29 15 0	1 mile	29 15 0	1 mile	29 15 0	1 mile	29 15 0	1 mile	29 15 0
Straining rollers .	40	0 14 0	40	0 14 0	40	0 14 0	40	0 14 0	40	0 14 0	40	0 14 0
Netting clips ..	22 gross	1 6 8	22 gross	1 6 8	22 gross	1 6 8	22 gross	1 6 8	22 gross	1 6 8	22 gross	1 6 8
Tying wire		0 3 0		0 2 3	..	0 2 3		0 2 0		0 0 9		0 0 9
Staples, clamps, or loops			.	0 6 0		0 9 6		0 9 6		1 16 0		0 4 0
Droppers .	..		320	3 12 0	480	5 8 0	480	5 8 0	480	2 9 0	480	2 18 0
Straining posts .	10	1 5 0	10	1 5 0	10	1 5 0	10	1 5 0	10	1 5 0	10	1 5 0
* Split posts . .	630	15 15 0	310	7 15 0	230	5 15 0	150	3 15 0	150	3 15 0	150	3 15 0
Permanent struts .	5	0 2 6	5	0 2 6	5	0 2 6	5	0 2 6	5	0 2 6	5	0 2 6
Erecting posts . .	640	6 8 0	320	3 4 0	240	2 8 0	160	1 12 0	160	1 12 0	160	1 12 0
Boring posts ..	640	2 13 4	320	1 6 8	240	1 0 0	160	0 13 4	160	0 13 4	160	0 13 4
Running, straining, and securing wire.	....	1 15 0	...	2 0 0	. .	2 0 0	.	2 5 0		2 5 0	.	2 5 0
Fixing and straining netting.	. .	5 10 0	...	5 10 0		5 10 0	.	5 10 0		5 10 0	.	5 10 0
Total . .	..	79 4 6		70 16 1	...	69 12 11	..	66 15 0		65 1 3		63 18 3

* NOTE—Cost per 100, £2 10s., made up as follows:—Royalty £1, Splitting £1 10s. per 100.

From the above figures it will be seen, under the conditions which prevail here, that the substitution of droppers in lieu of posts reduces considerably the first cost of the fence; but this does not determine the relative values of the different patterns, for in addition to cost, *efficiency* and *durability* have to be considered. Each style of fence has, since its erection twelve months ago, proved equally efficient to restrain the stock it was meant to restrain, and this during a summer drought, when feed was scarce on the side where the stock were and plentiful on the other side.

It may or may not be that the cost of maintaining the cheaper kinds in a state of efficiency will exceed that for the maintenance of the more expensive types in an equal state of efficiency. This point can only be determined by time. In order to do this, arrangements have been made to keep an account of the expenditure found necessary for the upkeep of each pattern of fence.

Arranged in their relative order of initial cost, commencing with the cheapest pattern, the fences will be as follows: –

	Per mile. £	s.	d.
Pattern F.—Posts, 33 ft. 0 in. apart, with 3 crimped wire droppers between posts	63	18	3
Pattern E.—Posts, 33 ft. 0 in. apart, with 3 plain wire droppers between posts...	65	1	3
Pattern D.—Posts, 33 ft. 0 in. apart, with 3 wooden droppers between posts...	66	15	0
Pattern C.—Posts, 22 ft. 0 in. apart, with 2 wooden droppers between posts...	69	12	11
Pattern B.—Posts, 16 ft. 6 in. apart, with 1 wooden dropper between posts...	70	16	1
Pattern A.—Posts, 8 ft. 3 in. apart, no droppers between posts	79	4	6

Barbed Wire.

It will be noticed that barbed wire has been used in the construction of the fences. This has been done with regret, but there can be no doubt that under certain conditions it prolongs the life of a fence by deterring stock from rubbing against it and unduly straining the plain wires. Everyone regrets having to use barbed wire on account of the risk which *always* attends its use; but until large stock can be controlled by moral suasion, or until some improved, better, and equally effectual medium is introduced, its use in certain districts is practically unavoidable.

Stock soon get to understand how dangerous it is, and when in a quiet condition are rarely injured by it; but once excited by panic or play, they forget its dangers, and often suffer in consequence. For some purposes, *e.g.*, to prolong the life of an old fence, it is invaluable, and despite its dangerous character, it is likely to stay with us. It may be that some style of woven fence will enable us to do without it; but for such a fence to be a success, it will require to have sufficient elasticity to recover from occasional very severe and unusual strains, and also sufficient to respond to our varying conditions of heat and cold, and so require no straining after its erection.

Rail Fences.

Whilst for boundaries and general subdivision work the rail fence has been superseded by the wire fence, yet for some purposes, such as yards, approaches to gates, bridges, &c., it, or the stub or sapling fence, is still required. Such fences are more easily seen than wire fences, and their appearance indicates that they are a more effective barrier than even the dreaded and dangerous barbed wire. Some details regarding them, their cost and construction, are likely to be of interest.

Three-rail fence (Fig. 5).—The erection of this type of fence is gradually becoming rarer and rarer. It is quite unusual now for a new one to be erected. The two-rail fence, with one or two wires underneath the bottom

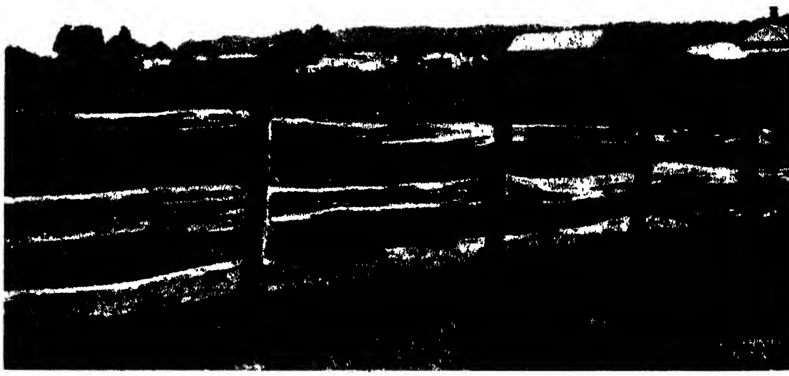


Fig. 5.—Three-rail fence, eight panels per chain. Cost, 7s. 9d per rod

rail, and between the rails, is effectually taking its place, except in very exceptional cases.

Fig. 6.—A two-rail fence and two-wire fence. Cost without wire, 6s. per rod.

The two-rail fence (Fig. 6) is largely used as indicated in the illustration—that is, for enclosing tanks, also for the yards about the homestead, stable, or dairy, and for other similar purposes.

The single-rail fence (Fig. 7), with three, four, or five wires beneath the rail, is very suitable, and is popular in some districts for enclosing town and suburban allotments. With the increasing scarcity of timber, it is now being used in many situations and for purposes which, formerly, only a two or three-rail fence would have been considered suitable.

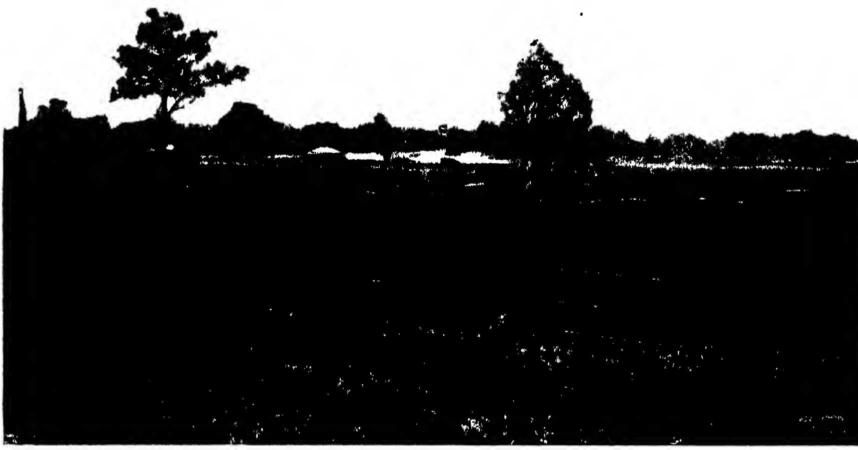


Fig. 7. Top-rail and wire fence; eight posts per chain.

With or without wires, it is a suitable fence on hill-side roads, to act as a barrier at dangerous places, to prevent travellers leaving the road.

The construction of the three kinds of rail fence is very similar. The following specification, which is suitable for this locality, will serve as a basis for those who contemplate erecting fences of this description:—

Rail Fences—Specification.

All fencing is to be on and in the proper line. The posts when erected are to be straight, uniform, upright, and in line along the tops; they are not to follow the lesser irregularities of the ground.

Timber.—White and yellow box or other approved timber may be used in the construction of the fence.

All timber is to be taken from large trees. It is to be thoroughly sound, free from splinters and other defects, barked, and straight. All measurements specified to mean at the smallest dimensions.

Posts.—All posts are to be sawn square on the top, and when erected are to have the earth placed properly around them and well rammed. The distance between posts is to be 8 ft. 3 in. from centre to centre.

Split posts are to be 6 feet 6 inches long, and to be 9 inches wide and $3\frac{1}{2}$ inches thick. They are to be placed 24 inches in the ground, and are to be mortised as per gauge herewith with holes 6 in. x 3 in.

Round posts for corners and ends are to be 7 feet long, and not less than 12 inches in diameter, they are to be placed 2 ft. 6 in. in the ground, and are to be mortised as per gauge herewith. The mortises are to be 6 inches long 3 inches wide, and 6 inches deep.

Rails.—The rails are to be 9 feet long, 8 inches wide, and 3 inches thick. The tenons on ends of rails are to be 6 inches long, adzed carefully to fit into the mortises; they are to be shouldered and finished so as to fill the mortise and to butt up to the posts.

Gauge for Mortising.—The posts will be mortised as follows, the measurements being taken from top of post to top of mortise:—

	Three-rail fence.	Two-rail fence.	Single-rail fence.
1st mortise...	6 in.	6 in.	6 in.
2nd „ ...	21 in.	28 in.	...
3rd „ ..	36 in.	...	..

Rail fences are usually erected at so much per rod ($16\frac{1}{2}$ feet), which comprises two panels. The approximate cost per rod of the fences is:—

Material	Three rail fence.		Two-rail fence.		Single rail fence.	
		s. d.		s. d.		s. d.
Posts	2 @ 6d. =	1 0	2 @ 6d. =	1 0	2 @ 6d. =	1 0
Rails	6 @ 9d. =	4 6	4 @ 9d. =	3 0	2 @ 9d.	1 6
		5 6		4 0		2 6
Labour		2 3		2 0		1 9
Total . .		7 9		6 0		4 3

The homestead fence (Fig. 4) is a neat ornamental type of fence which appears very suitable for enclosing the garden or front portion of the farm house. The fence illustrated is built of sawn timber, but where this is difficult to procure, and where straight saplings are plentiful, a very similar fence can be built with round posts and straight saplings for rails. A fence of this description, when painted white, adds considerably to the attractiveness of the home.

The particulars of the construction of the fence illustrated are as follows:—The posts are hardwood (ironbark), 5 ft. 6 in. long, 6 inches wide and 4 inches thick, placed 2 feet in the ground and set 9 feet apart. The rails are hardwood, 4 in. x 4 in., laid edge upwards in notches cut in the tops of the ordinary posts and morticed into the end and corner posts.

The rails are secured to the ordinary posts with hoop-iron No. 10 gauge straps 2 feet long by 2 inches wide, bolted to the posts with two 7 in. x $\frac{1}{4}$ in. bolts.

Six inches beneath the rail, rabbit-proof netting is attached by clips to three plain galvanized wires, which are secured to the outside edge of the posts by tying wire which passes through a hole 2 inches from the edge of the post. With this plan of fixing the plain wires, the netting can be strained as tight and as flat as a board, and when secured presents, as may be seen from the illustration, a neat, even, flat surface.

The cost per panel (9 feet) of this fence is, approximately, 9s., made up as follows:—

	s.	d.
Material—		
Posts—6 in. x 4 ft. sawn ironbark	2	9
Rails—4 in. x 4 in., sawn hardwood	3	0
Hoop-iron—No. 10 gauge, 2 ft. x 2 in., 2 lb.	0	3
Bolts—Two 7 in. x ¼ in.	0	3
Netting—A grade, 17 gauge, 42 in. x 1¼ in. mesh	1	0
Plain galvanized wire ....; Clips ....; Tying wire	0	3
Labour—		
Erecting	1	6
	9	0

Gates and Gateways.

Gates.

No fence is complete without an entrance, and therefore without a gate, for slip-rails at the best are only makeshifts, and are a source of loss both of time and temper. It is surprising that slip-rails are as common as they are, for excellent and serviceable light gates can now be purchased very cheaply, and even where the lack of cash is an obstacle to this being done, a handy man can, with the aid of an augur and a tomahawk, build and hang a strong useful bush-gate, with no other outlay than the expenditure of a few hours' labour, and certainly in less time than is required in the continual putting down and up of the slip-rails.

There are some who prefer something a little neater than the bush gate, but who wish the outlay to be as small as possible; for such, the batten-gate is admirably suited. The cost of the material required is not great, the gate is easily and quickly constructed, and if by accident it is injured, it is easily repaired.

In the November, 1905, *Gazette* (page 1127) the construction of a gate of this kind is described by Mr. Gennys, so that little more need be said on this point.

It is the more common practice to make these gates of hardwood; but an objection to hardwood is its heaviness—for a heavy gate is generally the principal cause of its own inefficiency and final destruction. For this reason the gates at this farm (which are similar to those illustrated) (Figs. 8 and 9) have been made of Oregon pine, which is light It may be thought that Oregon pine is not strong enough for the purpose; but such a supposition is not borne out by actual results, for I know of Oregon batten gates erected some nine or ten years ago on a dairy farm, where they have been in constant daily use ever since, and are still in excellent condition. They have never been broken or out of order during the whole time. It will be admitted that this material is strong enough for ordinary conditions of service, and that if it be broken it will be by some unusual act of violence, which, in most cases, would probably have been sufficient to have broken one constructed of hardwood.

The pair of gates as illustrated (Fig. 8) are 16 feet wide. In most situations on farms it is advisable to have openings of this width, as the transference of implements like the reaper and binder from one paddock to the other is greatly facilitated. It will be noticed that the bottom batten is put down to within an inch of the sill. This is in readiness to carry the netting when the paddock is made rabbit-proof. The tops of the uprights are rounded off; this gives the gate a neat appearance, and is less dangerous than having the ends pointed, as is sometimes done.

For openings up to 12 feet wide, a single gate, if made of light wood, may be made to do. The cost will be less, and a single gate is certainly more convenient than a double one.

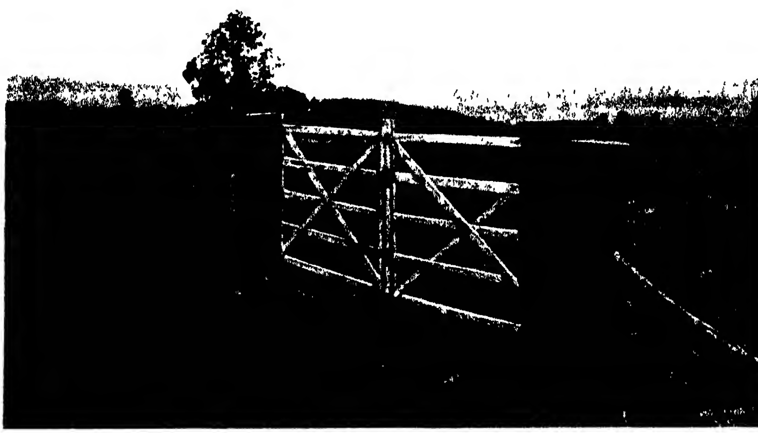


Fig. 8.—Gateway with round untrimmed posts. Cost of gates, per pair, 16s. 2d

The pair of gates, as illustrated, can be made ready for hanging in half a day. The materials used were—

	s.	d.
160 run feet = 40 super. feet, 3 in. x 1 in. Oregon dressed all round, at 23s. per 100 feet super.	9	2
Bolts, $3\frac{1}{2}$in. x $3\frac{3}{8}$in., 3 x $\frac{3}{8}$ in., $2\frac{1}{2}$in x $\frac{3}{8}$in.; washers, nails . .	1	0
Two pairs hook-and-eye hinges 2 ft. x 2 inches x $\frac{5}{16}$in; 18 lb. at 4d. per lb.	6	0
	16	2

The gates cannot be said to be finished until they have been painted, and the soundness of painting as an investment cannot be gainsaid. It will be better, and a saving of time, if the timber, after being cut up for the gates, is given a couple of coats before being put together. The gate, after it is completed and hung, can be given a final coat. The first, or priming coat, should be very thin, in fact may be nearly all raw linseed oil. The second and last coats will, of course, be a little thicker, and in order to dry hard, and with a little gloss, should contain a small quantity of turpentine and boiled oil. With regard to colours, tastes differ, but judging by results, white, in this

climate, seems to give the most satisfaction, and I understand the best quality of white paint is a mixture of white lead and oil. Painting the ironwork (hinges) black will make a slight contrast, and will rather add to the improved appearance of the gateway.

Gate-posts.

These should be quite separate and distinct from any posts used in the construction of the fence. A better effect is obtained without additional trouble if they are slightly higher than the uprights in the gate, also higher

Fig. 9.—A gateway with squared and trimmed posts. Cost of gates, per pair, 16s. 2d

than the fence-posts adjoining the gateway. The main entrance to the farm, and also the gateways around the dwelling, may be still further improved if a little additional trouble be taken to square the gate-posts and round off the tops. The amount of improvement effected by this may be judged from a comparison of the illustrations, (Figs. 8 and 9). The four posts in the gateways shown were practically identical as they left the bush. The cost of trimming is about 3s. 6d. to 4s. per post.

The Parramatta and Siletta Oranges.

W. J. ALLEN.

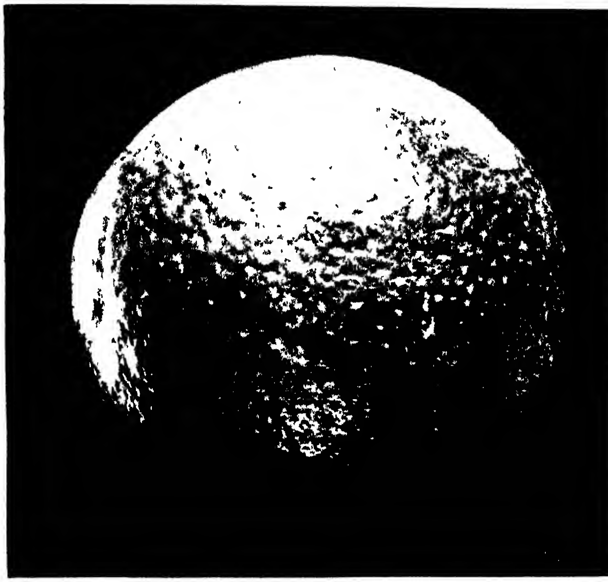
These are two varieties of oranges which have been planted rather extensively throughout our fruitgrowing districts where citrus fruits thrive. The Parramatta seedling has made a name for itself, and I have been informed by Mr. James Purser, of Castle Hill, that this variety was imported by Mr. Franklin many years ago, also by Mr. James Pye. The tree which Mr. Franklin imported was planted in the Pennant Hills district, in an orchard now owned by Mr. Phillips, and from this tree many buds and layers were taken. I am inclined to think that the original tree is dead, as although I have on several occasions inspected the trees in Mr. Phillips' orchard, I have not seen a tree which I would take to be eighty years old. It must be fully that length of time since this variety was introduced, as Mr. James Purser has a tree which he claims is seventy years old, and which is a layer taken from the original tree.

Mr. Morris Brown, of Galston, had a fine old bed, which is well-known to most fruit-growers, while Mr. Samuel Moore, of Dural, has some very fine trees, six years old, five acres of which this year produced about 1,500 cases of fruit, one of which I have had photographed. I have also taken a photograph of Mr. Purser's seventy-year-old tree, which measures 70 feet in circumference, and from which he has picked between sixteen and twenty cases of fruit.

Mr. Salmon, of Colah, has a very fine bed of old trees, which have produced splendid crops of fruit. There are dozens of other growers who have spoken in the highest terms of this variety, and who claim that it is one of the best of the old varieties to grow.

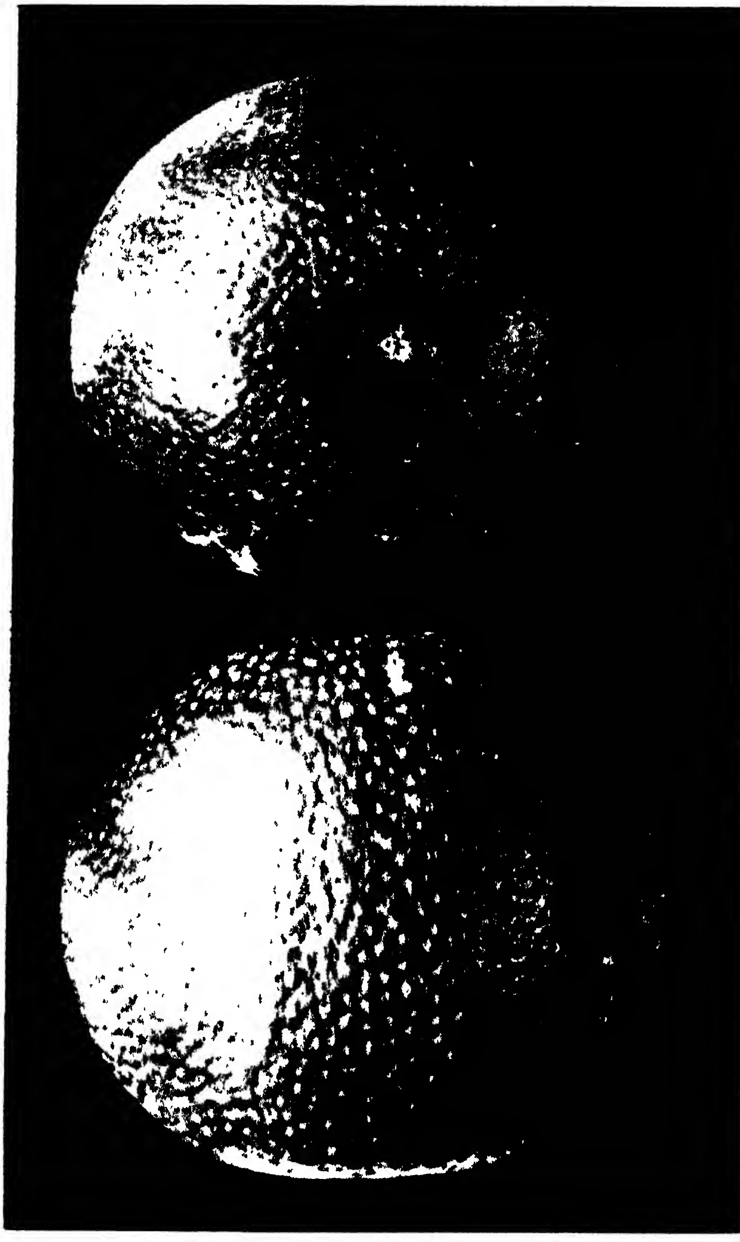
Tree upright, spreading, inclined to be very thorny, a heavy and regular cropper. Fruit, medium size, and hangs well in the later districts.

Siletta.—Although this is not so largely grown as the Parramatta, there are a good many trees of this variety under cultivation. It has the advantage of being almost thornless, consequently there is no loss from thorn picked fruit. It bears regular and heavy crops of medium sized fruit, juicy, and excellent flavour. It hangs very well in the later districts, and has proved itself to be a very profitable variety to grow. Skin fairly thin, of good colour.



TYPICAL SILETTA ORANGE.

SILETTA ORANGE-TREE, 17 YEARS OLD.
(Mr. Jas. Purser's Orchard.)



TYPICAL PARRAMATTA ORANGE.

Parramatta Seedling, 70 Years Old, 70 ft. in Circumference.
(Mr. James Purser's Orchard.)

Young Parramatta Seedling, 6 Years Old; 5 Acres produced about 1,500 Cases.
(Mr. S. Moore, junr.'s, Orchard, Dural.)

Farmers' Fowls.

[Continued from page 72.]

G. BRADSHAW.

CHAPTER XXVII.

PLYMOUTH ROCKS.

THE following introduction to the above breed was given in the *Agricultural Gazette* in 1887, and with a slight alteration will suffice for this contribution on the one-time well-boomed in this country Plymouth Rock fowl:—

"Varieties or breeds of poultry have, like some animals and flowers, on introduction, been the subject of a boom or craze, and of recent years none more so than the Plymouth Rock. The show-pen records of this variety, for numbers, half a dozen years ago exceeded that of any other breed; the reported laying properties, table qualities, and size, combined with a handsome appearance, stamped them as the best all-round fowls, and the colonies, always eager to emulate the mother country, rushed them to such an extent that for some years the value of the importations from England was much in excess of any other breed. Both fanciers and ordinary poultry-breeders got smitten with what was then called the 'Rock fever,' abandoning older breeds of tested utility in their favour.

"However, in two or three seasons, the crisis was reached, with the natural result that they rapidly declined in public favour, and now only occupy a third or fourth rate place with practical poultry-keepers. Good exhibition specimens are found in but a few fanciers' hands now, while the numbers exhibited at our shows are only about the fourth of what they were a few years ago, newer varieties superseding them."

The alterations are but slight, the popularity of half a dozen years ago can now be read as thirteen or fourteen years, while the reference to the numbers exhibited can now be said to not reach more than a tenth of what they did in the early nineties. At that time they made the records in the shows for the quantities exhibited, while now they are beaten by several breeds and varieties. The breed was then, in Australia, England, and elsewhere, considered one of the very best; and so far as the country of its origination is concerned—America—it still holds the leading position, whether as a fancier's fowl for the show-pen, or a commercial one by the farmers, as judged from a profitable point of view. The evidence on the latter grounds being that it is bred in America, by fanciers and farmers alike, in greater numbers than any other breed or variety. As an egg-producer, the many experiments made at the various United States Agricultural Stations have in some instances shown it as leading all other breeds, while as a roaster, boiler, or fowl for export to England, it is approached by no

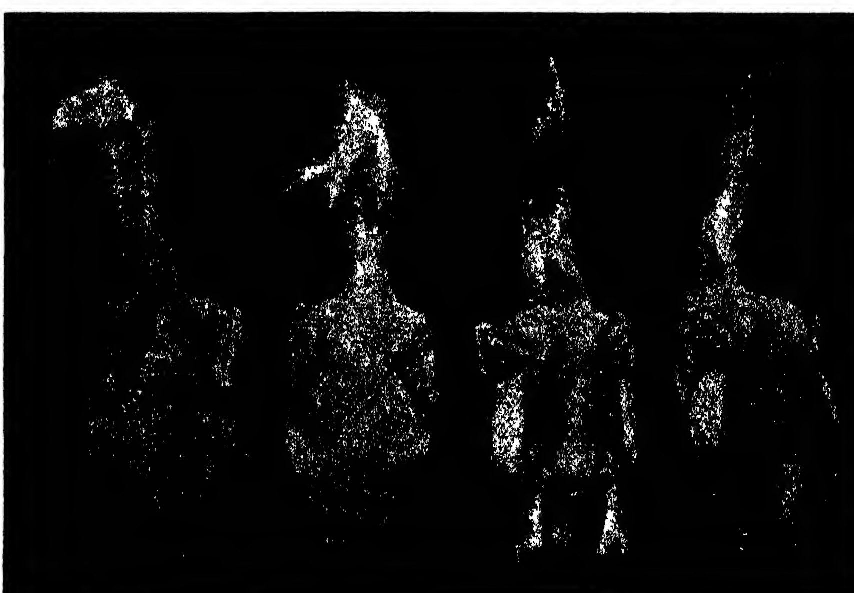
other breed. Who of the numerous claimants originated them is of no note, except to say that a Dr. Bennett did produce a bird from a Cochin and Malay to which he gave the above name, but as they produced offspring with red and other coloured feathers they soon died a natural death, the present blue-barred fowls being the result of experiments with the American Dominique, Java, and other breeds. The name is that of a tribe of American Indians, and Mr. T. F. McGrew, who recently wrote a history of the American breeds for the United States Department of Agriculture, says: "When first produced no other name was needed; they were simply Plymouth Rock fowls, and became well known under this title the world over. No other fowl has ever enjoyed equal popularity in this country; and and we presume they are better known, and at the same time less understood than any other fowl of minor reputation. More has been written about them than could be read in years, and there have been almost as many opinions and theories placed before us as there are writers. This has caused considerable confusion until the alarm sounded ascribing retrogression to the breed, when the attention of those best able to cope with the difficulty became attracted, and marked improvement soon followed. There seems to be no condition, surrounding, or climate unfavourable to the Plymouth Rocks. Their constitutional vigour appears to have no limit. Where any fowl can live they will prosper. They stand confinement, and when allowed freedom prove excellent foragers. They are prolific in yielding medium-sized brown eggs of the richest flavour. Under all conditions they will produce fully as many eggs as any thoroughbred fowl."

Prior to the origination of the Plymouth Rock, America had no breed which they could actually claim as their own, and as the great want in all the American markets was a compact fowl, having close-grained flesh and yellow skin, and averaging from 6 to 8 lb. when dressed, the experienced breeder, with an eye to utility, saw in this robust constitutioned cross-bred one eminently fitted to supply such requirements, for beside weight they had the additional quality of putting on flesh readily, and laying a large number of good-sized eggs. In addition to this they had a pleasing form and a general appearance that would impress one with the idea that they were a useful fowl. From the time they were acknowledged as a pure breed and known as Plymouth Rocks, they became most popular in the land of their inception, and are at the present day exhibited in greater numbers than any other breed, possibly Wyandottes excepted. As showing the estimate in which the Plymouth Rock is held in that great country, the following figures are those recorded at the St Louis Exposition during October, 1904:—

	Cocks.	Hens.	Cockerels.	Pullets.	Breeding Pens.
Barred Rocks... .. .	50	57	59	92	25
White Rocks	56	69	67	70	38
Buff Rocks	59	70	87	110	29

In previous poultry articles I have mentioned that we in Australia generally follow in the wake of the English poultry-men. In other

A case of 12 Chicago Plymouth Rock Chickens as opened in Sydney. Papers removed from heads of four.



Four Chicago Chickens taken from case, showing fatted back and well-fleshed breast.

words, when a breed or variety of fowls gets plentiful and popular in England, there also comes a run on them here. This was the case

B

with Rocks, as in other breeds; but, strange to say, when Australia began to tire of the Rocks, such was not prompted by any like action in England, for the breed at the present time in that country if not bred for utility purposes is certainly still a favourable one with show-goers, as can be realised by the fact that at the Dairy Show held in the first week of October last, and which is for birds of the year only, there were 34 Barred cockerels and 40 pullets; 12 Buff cockerels and 10 pullets; and 23 Whites, or over 100 entries. While coming to the Crystal Palace and the International Shows, held a month later than the above, there was a combined entry of considerably over 300, much less than either Orpingtons or Wyandottes, but numbers sufficient to show that the Plymouth Rock holds a forward place in the English poultry world.

Regarding the merits of the breed, they are many; but the very fact of them declining in favour here is for the simple reason that other and newer sorts have greater economic merits. The Mediterranean breeds, the Orpingtons, and Wyandottes are more profitable fowls to keep, and this is the basis by which farm stock at the present day are valued.

Concerning the merits of the Rocks as table fowls, they are highly valued by the Americans, both for the family table as well as for the hotel trade, and although their English export business is a small one in comparison with that done by continental countries, still the many thousand head which go to London are chiefly Plymouth Rocks, despite the fact that a white-fleshed fowl is more favourably regarded in England.

The late Commercial Agent, Mr. Lance, at the instance of the Director of Agriculture, secured during the past year in London a case of chickens from Chicago and forwarded them on here for inspection. All were Plymouth Rocks, Barred, Buff, and White, the different colours being recognisable in the accompanying illustrations. The birds were so extremely fat as to at once show they had undergone a course of fattening, and were approximately about five months old. The individual weights of the birds were as follows:—3 lb. 15 oz.; 3 lb. 9 oz.; 3 lb. 8 oz.; 3 lb. 14 oz.; 3 lb. 9 oz.; 3 lb. 10 oz.; 3 lb. 12 oz.; 4 lb. 3 oz.; 3 lb. 14 oz.; 3 lb. 10 oz.; 3 lb. 7 oz.; 3 lb. 9 oz.; or a total of 44 lb. 8 oz., being slightly over 3¾ lb. each, consequently allowing for feathers and blood, the chickens would have been about 4¼ lb. each prior to killing. They were purchased in London at 3s. 5d. each, so that allowing the moderate charge of 9d. for dressing, freezing, case, freight, insurance, landing and selling charges, would thus leave but 2s. 8d. for the exporter, who, in his turn, must have a profit, all showing that the American grower must get much less for his chickens than does the Australian breeder locally for the greater portion of the year for those of quality much inferior.

Chapter XXVIII.

Plymouth Rocks as Layers.

There is scarcely a doubt but what contributes to the continued popularity of Orpingtons and Wyandottes in Australia is the fact, as previously shown, of both breeds being good layers, some pens in the competitions having averaged over 200 eggs for each hen; while taking the good and bad together, they have shown a total for each fowl of from 12 to 14 dozens each in the twelve months.

Concerning the Rocks, although there are instances recorded in America where they made over 200 each, still in many cases they are considerably under this number. The American author I have already quoted gives the average yield as 150 eggs, and supplies the weight as 23 oz. to the dozen, a size which if accepted as a fair average in America certainly would not in Australia.

So far as the laying of the Rocks here is concerned, perhaps the worst that can be said of them in that respect is that not a single patron of the breed ever ventured to test it at any of the Hawkesbury College competitions.

At the 1904–5 test, which consisted of 100 pens of six birds each, seven pens of these were Americans, and one consisted of White Plymouth Rocks, owned by D. T. Roots, and accepting them as representing the American Rocks, their record is exactly that of the experienced breeder employed by the United States Government to write a history of the breed. At the close of the College contest the American Rocks occupied the 86th place in the hundred, the pen laying 775 eggs, or 129 for each hen. The eggs, however, averaged but 23½ oz. to the dozen; still to be strictly fair it should be mentioned that the eggs from a few pens of our own fowls weighed as low and some less, still there were over eighty lots whose produce weighed from 24 oz. to as high as 31 oz. for the twelve eggs. It should be said that age was in favour of the American hens laying larger eggs than ours, seeing that they were 10½ months old at the commencement of the test, whereas the bulk of ours were mere pullets of 7 and 7½ months old. In concluding this reference to the laying of the American Rocks, although it conforms with the bulk of the American writers, still one pen is not sufficient from which to draw definite conclusions.

In the 1905–6 Hawkesbury contest, not a single Rock appears, while for the 1906–7 competition, which begins on April 1 next, not one of the Plymouth Rock breeders have responded, these later experiences confirming my opinion as expressed in the *Gazette* in 1897 as follows:—"The majority of those who have given up the breed pronounce them as rather poor layers of eggs, which are small in proportion to the size of the fowls. The hens are much inclined to put on fat, which no doubt affects their laying properties. In spite, however, of their decadence, Plymouth Rocks have many good qualities. They

are very hardy, stand damp, cold, and confinement well. They are good sitters and mothers, the chickens are easily reared, feather quickly and are not much given to disease. Those who wish to breed poultry for home consumption, and can afford to keep the chickens until seven or eight months old, will find the Rocks a good variety to keep. The cockerels and pullets of this age, if fed and otherwise well-cared for, will be very large and meaty, one bird alone being sufficient for a good family dinner; but for the local or export market they cannot be highly recommended, for being fowls of a large frame, they are slower in developing than several other varieties, and, consequently, more expense is involved in bringing them to a marketable stage. During and for a few years after the Rock boom birds of this breed were to be found in moderate numbers in the poultry sale-yards of Sydney, but are now rarely seen there, Orpingtons and Wyandottes supplying their places."

White Rocks and Buff soon followed the origination of the Barred variety, and have also been bred and exhibited in this and other States, but to a limited extent, the evident reason being that more profitable sorts are available, and although at one time the Plymouth Rocks were fairly plentiful throughout the country districts, they have now disappeared, and are not likely to be resuscitated, or ever become a farmer's fowl.

(*To be continued.*)

Preparation of Pine-apple Syrup.

Choose very ripe fruit. Wash it well and cut into slices. In twenty-four hours these should be strongly pressed. The juice obtained is boiled, and while boiling must be kept carefully skimmed. After this it is allowed to stand for some hours to permit the impurities to settle. The clear liquid is then bottled. The bottles must first be carefully washed in warm water. Finally, the bottled syrup is sterilised. For this, the corks are secured with wire or strong string. The bottles are placed in a copper on a layer of straw, or a double bottom pierced with holes is still better. The vessel is filled with cold water and gradually warmed until it reaches boiling point. It is kept at this for an hour. When it is desired to concentrate the syrup, it should be allowed to evaporate under reduced pressure so as not to weaken the delicate flavour.—*Journal d'Agriculture Tropicale.*

Diseases of Poultry.

Scaly Legs.

G. BRADSHAW.

THE following paragraph in the *Sydney Daily Telegraph* of 4th November, affords the text for this contribution and illustrations :—

"Mr. McIntosh reports :—A large number of the birds are affected with scaly legs. Many showed signs of it on arrival, and had I then known that I would have to spend so much time curing and keeping the disease in check, I should have rejected them in accordance with the regulations."

It may be first mentioned that Mr. McIntosh conducted a laying competition on his farm at Rockdale, 300 birds competing, being a pen of six birds each from fifty different people, and composed of one pen each of Hamburgs, Minorcas, and Langhans, the remaining forty-seven lots being Orpingtons, Wyandottes, and Leghorns.

This ailment of the poultry-yards -scaly legs—is one that has long been recognised, but is more of a disfigurement than a disease, and its cure is so simple that one is prompted to wonder that such an insignificant, but certainly unsightly, ailment should have given such an experienced breeder as Mr. McIntosh cause of complaint, -except to laudably draw attention to the fact of the ailment being so general, as can be realised from the fact that the 300 birds represent such wide apart districts as Canterbury and Cumnock, Waterloo and Wagga, Sans Souci and Swamp Oak, Merrylands and Moree, Burwood and Blayney. It is very well known that the ailment is caused by a parasite, which burrows under and amongst the scales of the fowls' toes and shanks, throwing or building up a sort of coral formation, which is of a dirty-white colour. This scurf, in pronounced cases, becomes so thick and assumes such forms that the legs become quite deformed-looking, and not infrequently the incrustations have been found an inch thick ; while at times cases are seen where the toes have become so covered that the fowl is unable to bend them at the joints. In two of the cases illustrated this had taken place, and the fowls became lame, and ultimately unable to walk.

Mr. Lewis Wright, in his 1885 edition, says the disgusting ailment is most common in the Asiatic breeds—Cochins, Brahmas, and rarely in Langshans. As has been shown above, there is not an Asiatic breed but one competing ; still the trouble is most general. Another well-known writer says it is most prevalent in Plymouth Rocks, or other crosses with the Asiatics. Other writers offer other views, and whether their own actual knowledge or otherwise, the fact remains that Australian experience is totally at variance with the English and American theories The Rockdale competition, as has been shown, has only one pen of Asiatics included, the ailment being

general amongst the clean-legged varieties, there being neither Brahmas or Cochins amongst the 300. However, that is but a moiety of the practical Australian evidence against that of English theorists.

During the two years of the big export trade to South Africa, which consisted mostly of old hens, of the one hundred and ninety odd thousands

Live fowl, one leg treated, one untreated.

handled, not 2 per cent. were Asiatics, while from 15 to 20 per cent. were affected in the various stages of scaly legs. Coming to the present year's business of the several thousand head prepared, possibly the Asiatics were reduced to under 1 per cent. of the number, and the whole of the birds affected with this complaint had increased to nearly half of the entire number.

The cause of this disease, or rather ailment, has also received extended treatment from English writers, and here again the assertion made must only be accepted as opinions, all the wealth of experience here disproving them. Mr. Lewis Wright says:—"Without affirming that it is the only cause, we can safely say that diligent inquiry has demonstrated beyond a doubt a close connection between this disease and sudden exposure to cold, wet, and most especially walking in snow." Other English writers attribute it to the same cause. Now, we are all aware that New South Wales—particularly that portion of it wherein the bulk of the poultry is bred, the Sydney suburbs—is entirely free from snow, hence there is no possibility of fowls walking through what does not exist, while the other suggestion, that the ailment is due to wet and cold, is just as remote; the actual fact being that outside our water-laid-on radius the rain comes so intermittently that it has to be conserved, otherwise the fowls would be short of even drinking water, and when it does fall in quantities it disappears so quickly that wet fowl-runs are unknown, consequently, it must be assumed that wet has nothing to do with the cause. Further, as I have said above, that of the few thousand fowls prepared in the closing months of the year, fully one-half of them were more or less affected, while a few years ago more than three-fourths of the big number exported were absolutely free. From this it must not be inferred that the ailment is increasing, but rather that the increased percentage of affected birds was solely due to the source of supply. In 1901–2, when the respective numbers of 73,140 and 120,161 were treated at the Export Depôt, the birds came from all over the State, while those handled of late were largely from suburban and back-yard breeders, this confirming my own personal experience that birds running at large on farms, through brush and dewy grass, and more in accordance with natural conditions, are almost

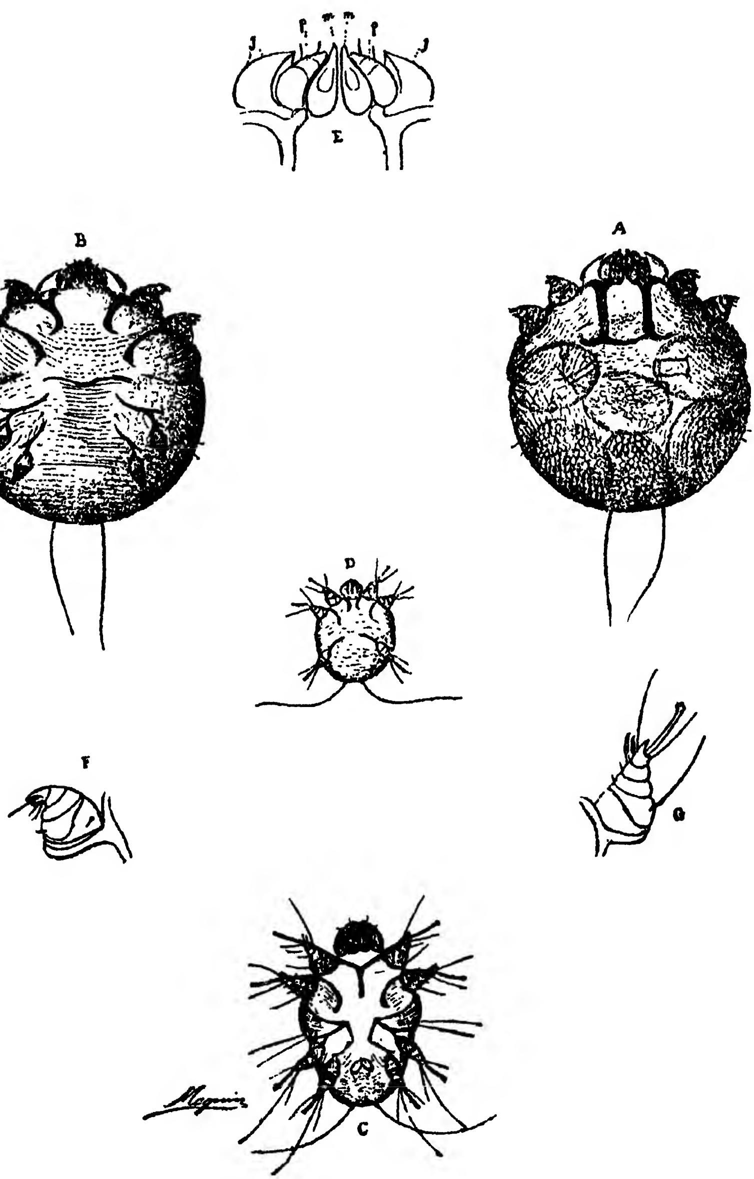
A pair of clean feet.

or entirely free from the trouble, while those penned in small dry yards and debarred from moisture on the shanks, which is associated with liberty, are, in the absence of preventive measures or treatment, much prone to the complaint. This is further confirmed by Mr. H. Cadell, who replies to Mr. McIntosh's paragraph which introduces this article. Mr. Cadell says :—"To read that pullets from six to eight months of age are infected speaks badly for the yards from which they came, since scaly legs are only a lazy, careless poultryman's disease, and can be easier prevented than cured."

These pullets arrived at Mr. McIntosh's farm infected, and as is well known the competition pens are devoid of grass or moisture, being simply sand; hence this, according to my view, contributed to the trouble, whereas had there been grass the ailment would have decreased. My own experience confirms this. A yard of about 15 Faverolles fowls, kept throughout the past season for laying only, having access and fed in a grass paddock up to the present time, have kept free from even a trace of the disease, while next door to them I had a cock and five or six hens penned up in a small yard for breeding, although supplied with green food were precluded from access to the grass paddock, the result being that the cock and three of the hens have developed scaly legs, attributable, it will be admitted, to neither cold, wet, or snow, but due in at least this instance to the dry influence of the sand, supplied ashes, and other moistureless *débris* which usually finds its way into small poultry runs, thus predisposing to the parasite and its coral-like existence and disgusting appearance.

A treated and untreated foot.

Another present-day experience of this microscopical parasite will suffice, and although a single experiment will not prove anything, still the case goes to show that religiously adhering to everything one reads about fowls may, in the absence of testing the statements, cause serious inconvenience. Almost everyone who has written of the disease says it is highly contagious, and seeing that it is due to a parasitic mite, such an assumption may be considered a safe one to make. Every poultry-keeper is aware of the importance of getting early chickens, the June and July hatched broods being easy to

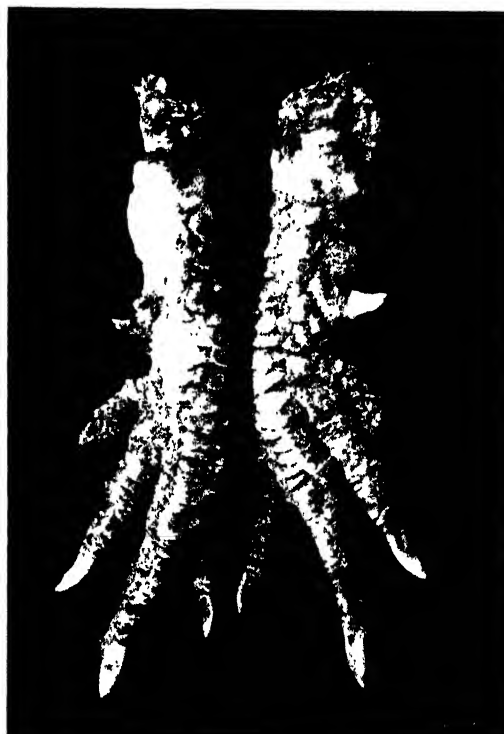


SCALY LEG.

PARASITE (SARCOPTES MUTANS) PRESENT IN THE DISEASE KNOWN AS SCALY LEG.

A. Female front view; B. Back view of ditto; C. The male; D. Six-legged larva; E. Rostrum—mm mandibles, pp. feelers, jj. cheeks; F. Front leg of female; G. Ditto male, nymphs, and young females.

rear. The pullets lay early when eggs are dear, while, if of sufficient merit, the early cockerels always stand the best chance at the show. Breeders are also aware of the difficulty in securing broody hens in the winter months. This was the writer's experience in the early part of June last. However, one was procured which, on examination, was in such a state with scaly legs, that anyone believing the contagion theory would not have put valuable eggs under her, her legs being actually distorted with the growth. The chickens hatched by this hen are now six months old, three of the pullets are laying, while the cockerels weigh 6 lb. 4 oz., 6 lb. 8 oz., and 6 lb. 10 oz. each respectively, and all are as free from scaly legs as the day they were hatched. This, however, does not tell all. The hen was cooped up for a week or two and afterwards given liberty with the chickens in a grass run, and at the present time much of the incrustation has fallen off, and although I do not anticipate that in the absence of treatment the legs will become normal, still the case further proves that the disfigurement due to carelessness on the part of the owners will, on the return of the fowl to natural conditions, become scarcely perceptible, and amenable to certain cure by a simple scrubbing with soap-suds.


A bad case of scaly leg.

Whatever difference of opinion there may be in regard to the cause of the ailment, the majority are agreed that it is not difficult to cure. At the same time there is no need for the elaborate treatment suggested by the English writers, many of the cures being cumbrous and difficult of application, some expensive, while the others, such as sugar of lead, turmeric, carbolic, &c., are wholly unnecessary, as is the internal treatment suggested by another authority, the actual facts being that the most severe cases can be cured in an easy and inexpensive manner. The most simple and certain way to cure the disease is that which is so effectively shown in the photograph of the live hen, with one leg in a most pronounced stage of the disease, and the other perfectly clean, the result of three simple treatments. This specimen came to the

depôt on 4th December, to be killed for export. On the same day, a 1 lb. empty jam tin was procured and filled with kerosene. One of the hen's legs—that shown clean—was placed in the tin, and allowed to stay there for about 40 or 50 seconds. Kerosene is most penetrating, and this time allowed it to thoroughly permeate the incrustation, and thus kill the parasite. The hen was put back in the coop, and the process repeated the following day, by which time large pieces of the ugly growths had dropped off. On the third day, the legs got a thorough scrubbing with warm soapy water, an old toothbrush being used. The following day the bird was photographed as shown. The other illustration showing a clean leg and its fellow diseased, was treated in the same way, but after the fowl was dead. The other photographs illustrate the extent and forms the disease assumes. In two of the instances the growths had covered the joints to an extent rendering them immovable. The bird being thus unable to scratch accounts for the inordinate length of the toe-nails through being put out of use. Other simple remedies are equally effective as that quoted, and all easy of application. A dressing of sulphur ointment for three or four days in succession, followed by a washing with warm soapy water; sulphur mixed with lard or other kitchen fat will do. Mr. Cadell's remedy is as effective as any, namely, several applications of kerosene and kitchen fat. In cases where the incrustations have not assumed great growth, a scrubbing with suds will be sufficient, while of the various things most effective soft soap is perhaps best. In instances where kerosene is used, it will be less severe on the fowl to mix it with hot suds.

To prevent the ailment, an occasional dressing of the fowls' legs at night with kerosene and household fat or oil will be effective, and the painting of the fowls' perches once or twice a month with kerosene will keep all mites away, and ensure clean-legged poultry as well. It may be mentioned that the name of the disease is *Elephantiasis*, and that of the mite *Sarcoptes mutans.*

Since writing the above two English poultry papers of latest date have arrived, containing the following answers to correspondents on the above subject, from which it will be seen that the poultry authorities in England are abandoning the cumbersome cures at one time recommended, and are looking upon the disease as a simple one, and easy of cure. The kerosene or paraffin methods, it will be seen, are advocated :—

"Scaly Legs (J. Clark).—There is no difficulty in removing scale from the legs of a fowl. There are several ways. Brush the legs well with hot soap and water. Then rub in neat paraffin. Or you may boil water and mix with it as much paraffin as its own bulk, and brush this well in, too, or you can brush on carbolised vaseline. I like the brushing in better than the mere rubbing on, because it gets under the scale of the legs and feet, and so cleanses the limbs thoroughly. If the scale is allowed to go on for long it will eat into the leg until the place is quite in a wound when the scale is roughly removed in a lump. Your chances of a prize with a scaly-legged bird are not very bright; in fact, you ought not to win because it shows that a bird has been neglected."

"Scaly legs should first of all be dressed with paraffin alternate nights for a week. At the end of that time soak the legs in warm water and take an ordinary nail-brush and some soap and give the legs a good scrubbing. Having done this, thoroughly dry the legs, and apply an ointment made of equal parts vaseline and sulphur each night for a week. Then wash the legs again as before, and after drying them apply olive oil. They should be then in nice condition, and will keep so if now and again a little sweet oil is applied and the legs kept perfectly clean."

"You did the right thing in washing the legs in paraffin; now you should apply some good ointment nightly, then at the end of a week well wash the legs with hot water and scrub them with an ordinary nail-brush on which you have rubbed some soap, carbolic for preference. If the legs seem better when dry, then dress with sweet oil and let the birds go."

From all the above it will be seen the malady is a simple one resulting from neglect, and the remedial measures are at all times available and easy of application.

Preserving Lemon or Lime Juice.

The juice as it is squeezed out from the fruit is allowed to rest for 24 hours until a sediment collects at the bottom of the vessel. Then the clear liquid is decanted and reduced by heat to one-third of its volume, *i.e.*, three quarts of juice would be reduced to one quart. The heating process should not be done by direct fire, but by standing the vessel containing juice into a copper or some larger vessel over the fire. On a large scale a water bath or steam circulating in a jacket boiler could be used. In any case, the vessel in which the juice is heated should be enamelled.

The juice may be sweetened by adding 4 to 5 lb. of sugar for every gallon of juice before it is reduced by heat. It is bottled when cool, but before bottling it may require straining or filtering.

To prevent deterioration by mould, the bottles, which are filled to an inch from the cork (which is tied down), are placed standing in a flat-bottomed boiler. Water is placed in the boiler up to an inch from the neck of the bottles, and then heated by direct fire up to 170 degrees Fah., and kept at that temperature for about 25 minutes. Then they are removed and laid one side, *never standing*. To prevent heating of the bottles it would be well to have a false perforated bottom of wooden battens placed in the boilers.

The method of keeping fresh lemon juice, as used in the navies, is to add 10 per cent. of brandy; that is, one gallon of brandy to nine of juice after it has been heated.—*Journal of the Jamaica Agricultural Society.*

Some Hints on Tanks and Dams

R. H. GENNYS.

MANY areas of land taken up for grazing and cultivation have no natural permanent water supply, therefore the matter of providing a sufficiency of this most necessary element should be a first consideration with the settler taking up the land.

It is somewhat difficult to arrive at the quantity required for sheep and for cattle say over a period of twelve months. Every person must be his own

Excavated tank.

judge as to whether the weather conditions of his climate warrant him in providing for a shorter period, or whether in the driest parts it will not be wiser even to provide for a longer period. The following might be noted: Sheep, more especially when there is plenty of green feed with a moderate temperature, require very little water, indeed, they have been known to go months without any and do well. When, however, feed is dry and dusty they drink a great deal. When there is a drought and weather very hot they almost live on it, and the evaporation in hot weather is enormous—another thing, they often take a lot out in their wool. Taking these things into consideration, and also the depth as I before mentioned, I shall say that $1\frac{1}{4}$ gallons per day for each sheep should be provided. This will make the requirements of each sheep for one year $456\frac{1}{4}$ gallons. Well, each cubic yard of water contains $168\frac{3}{4}$ gallons. This comes to about $2\frac{3}{4}$ cubic yards per sheep, and as before mentioned it is always safer to provide a little more. I will

advise 3 cubic yards of water be provided for each sheep intended to be watered at your tank, or tanks, or for 100 sheep provide 300 cubic yards of water; for cattle and horses, from 24 to 30 cubic yards should be provided for each beast for one year.

Having considered the quantity of water in cubic yards that will be required for the maximum number of stock intended to be kept; providing for the driest seasons, and of water there should always be more than enough.

Next, select the most convenient position or positions on the estate for watering stock. Tanks or dams may be placed so as to water more than one paddock if required. If the paddocks are large, however, it is better to place the excavations as near the centre as possible, in order that stock may not have to travel too far to water and will not tread down the grass so much going to and fro. There must be a sufficient catchment area that will run water enough to fill the excavation in good heavy rains. A large area with gentle grade being preferred to too quick a catchment—the latter carries too much soil and rubbish down during heavy rains. See that the area is kept clean and does not contain pig-styes, sheep-yards, &c.; also, shade-trees should not be left in the catchment, but rather below it, so that the excreta from stock camping under them may not be washed in and pollute the water.

Now comes a very important point—that is, that good clay is chosen so that the water will not leak away. It is worth all the trouble to sink a few trial holes to the depth required, and see what the clay is like all the way and that no rocks are in the area proposed to be excavated, as getting rid of even a few feet of these is an expensive process, and rock bottoms, as a rule, do not hold water well. The first foot or so of top soil may not hold well at first, but this is not of much consequence, as a little stocking will soon tread this down and make it hold. Any man used to mining can go 12 or even 15 feet in good sinking in a day; the shaft need only be big enough for him to go down in, and the earth can be thrown up most of the way.

In all cases it is advisable that a small silt tank should be made, into which all drains should flow, the overflow from it only being allowed to go into the main excavation. These silt tanks can be cleaned out easily when required; and they need not be made too deep, say 5 to 6 feet; the drain leading from them to the main tank should be stone-pitched and also continued right down the slopes to the bottom to prevent the earth being cut away; sometimes hollow logs are used to shoot the water clear of the batters. *Iron fluming* is altogether too dear and quite unnecessary. In making artificial water supply, *depth* is what should be aimed at, the surface to be of as small an area as possible, consistent with facility for watering stock and preservation of the slopes. Very steep slopes are soon trodden down, mud and clay falls in, and soon destroys the shape of the excavation and fills it up. This applies to tanks that are not fenced in and that stock are allowed access to all round. *Sheep only* should be watered at these, and the slopes should not be less than 3 to 1. If made with bullocks, ploughs, and earth-scoops these can be taken out at this grade all round, but this is

too steep for cattle and horses to water at—in fact, all excavations intended to be used for large stock should be fenced in and access given to them at one side only, which is generally termed the roadway. This should have a grade of from 4 to 1 to 5 to 1, and should be corduroyed or stone-pitched—the latter is more lasting and safer in every way. This can be done by making an excavation 7 or 8 inches deep and filling in with large stones placed on edge, and all interstices tightly wedged with spawls or small stones to an even surface and then blinded with gravel a few inches thick. The other slopes may then be graded to 2 to 1, in order to make the average depth as great as possible, and expose a small surface to the rays of the sun. Evaporation and consequent loss in depth is very great in summer and is an important factor to be reckoned with. Move all earth taken out at least 1 chain from the nearest edge of the excavation, in order that it may not be trodden or washed back into the latter. The earth should be placed neatly and of sufficient width to permit a cart to move safely along the top; the higher it can be taken, providing a good base is secured, the better, as it protects the surface against winds, which agitate and make waves, thus drying up the water. In dam-making, the matter of providing a sufficient getaway, or by-wash, is a very important matter, and the greatest possible flow of water should be provided for, as, if not, many months work may disappear in as many minutes, and a valuable supply of water lost. Of course, the by-wash must be on the lower side, and should not be too much confined, but allowed a wide sweep. Close to the end of the embankment should be stone-pitched to prevent cutting away of the earth, injuring the latter and, perhaps, forming gullies which ere long will give much trouble; an old watercourse well-grassed over can often be used with much advantage. Where sufficient water will not flow naturally into the excavation, drains should be made, and, as before mentioned, should all flow into the silt tank; these should have a fall of not more than 6 inches to the chain, 4 inches being generally sufficient to allow the water to run freely; if a greater fall is allowed the drains will cut away and much rubbish washed down into the tank. An ordinary drain—that is, one that does not receive other drains, but only the water collected in its course—might be made an average depth of 1 foot, the bottom to be about 1 foot wide with slopes 1 to 1. For a main drain—one that receives two or more laterals—of course, should be made much wider. Width and not depth is the important feature in drains. The junction of the sides with the bottom should not form an angle, but should be rounded off.

When a dam or tank gets dry, clean out silt at once, as the opportunity may not occur again for a considerable time; this maintains the depth and also keeps pure the next volume of water that flows in. *Couch grass* may be sown with advantage on dam heads—it binds loose material wonderfully and keeps it from frittering away. Before taking out any earth and constructing the embankment, it is advisable to plough the surface on which the latter is to rest about a foot deep, and, if this is of a very porous nature, remove it and fill in with better material. As soon as the excavation is complete, fence down the edges of the roadway and right across the bottom before any water gets in.

Rule for Measuring Tanks.

Add together the top area and the bottom area, together with four times the middle area. Divide result by 6, and multiply by the depth. If the measurements are in feet divide by 27, and the result will then be the size of the excavation in cubic yards. Thus:—

		ft.		ft.				
Top	...	60	×	80			=	4,800 top area
Bottom	...	20	×	20			=	400 bottom area
		40	×	50	×	4	=	8,000 middle area × 4
								13,200

13,200 ÷ 6 = 2,200

2,200 × 10 (depth) = 22,000 cubic feet

22,000 ÷ 27 = 814·81 area of tank in cubic yards.

If you want to find size before sinking you can obtain the length and breadth of what the bottom will be on completion. Thus: This tank has the top measurements 60 feet by 80 feet long; depth, 10 feet; slopes on three sides 2 to 1, and on one side (the roadway) 4 to 1; in the breadth, 2 to 1 for 10 feet = 20 feet (this on either side) = 40 feet. This subtracted from 60 feet leaves 20 feet in breadth at bottom. In the length on one side, 2 to 1 slopes × 10 = 20 feet; and on the remaining side, which is 4 to 1 by 10 feet deep, = 40 feet. For both sides 60 feet to be taken off from 80 feet in length of top, leaving 20 feet, thus 20 feet × 20 feet will be measurements of bottom.

Hawkesbury Agricultural College and Experimental Farm.

Experiments with Nodule Culture.

G. MARKS,
Experimentalist, Hawkesbury Agricultural College.

On examining the roots of peas, beans, vetches, clovers, or lucerne, one will usually find scattered over their exterior surface tubercles of various sizes and shapes. These are, with few exceptions, peculiar to one order of plants—the Leguminosæ. The tubercles are the outgrowth of the plants themselves, and are produced by the action of certain micro-organisms working within the tissues of the roots. Formerly, these tubercles were considered abnormal appendages, and injurious to the plants; but later observations have revealed the fact that, where they were absent, the plants did not make the growth seen in those where the tubercles were present. Further examination has found that these tubercles are the homes of minute microscopic bacteria (*Bacillus radiciola*, Beyer). These bacteria have the remarkable property of taking in the free nitrogen of the air which is present in the soil, and transforming it into available compounds for plant-food. Here is a case of symbiosis—the plant supplying food and shelter for the bacteria, and the latter furnishing in return the plant with nitrogen. This is why the leguminous class of plants are so valuable as soil-enrichers, and particularly useful for a place in the farm rotation, besides being highly prized for green manuring.

All the problems raised in connection with the assimilation of free nitrogen through the intervention of root tubercles have not by any means been solved. Even the best authorities seem to differ on some of these points; but it is pretty well agreed that the tubercles are the result of a micro-organism, and, as they attack the roots, it is naturally supposed that they exist in the soil. It is also noticed that the nodules on different species of leguminous plants vary in size and shape; but whether the organisms that produce these are different species for the separate classes of plants, or modifications of the same species, is yet a disputed question.

The introduction of leguminous crops in the rotation is so important, and the benefits to be obtained in the improved condition of the soil and increased returns so apparent, that any method which would assist these plants in fixing the free nitrogen of the atmosphere would be gladly welcomed. Experiments with transferring soil in which the proper organisms have been grown have been tried in Europe and America, but not with universal success. In any case, it is impracticable to the farmer, involving a great

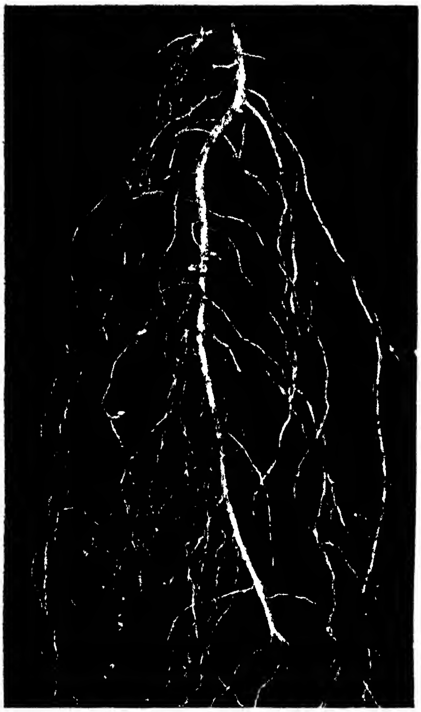
deal of labour and expense, and a further more serious objection, because of the possibility of transferring plant diseases from one field to another.

To obviate at least some of these difficulties pure cultures have been prepared. The most recent of these are the cultures made by Dr. Moore, of the United States Department of Agriculture, who thus describes his method:—"In order to secure artificially a satisfactory inoculation of any leguminous crop, it is necessary that the greatest precaution be taken in procuring the original culture. Absorbent cotton is saturated in a liquid culture of the nodule-forming organism. In this way millions of the bacteria are held within the cotton, and, after this is carefully dried, they remain dormant, in much the same way that seeds do, waiting for the proper conditions to revive them. Where it is possible to obtain sterile utensils, and to prevent absolutely the entrance of micro-organisms, it is sufficient to insert the inoculated cotton into sterilised water when, in the course of time, the bacteria will have multiplied sufficiently to produce a decided clouding of the culture, and will be ready to introduce in the ground. This would require too long, however; and it is also difficult, when preparing to treat large quantities of seed, to prevent the entrance of other bacteria—moulds, yeasts, &c.—all of which may have a deleterious effect upon the nodule-producing organisms. For this reason it has seemed best to prepare the water in such a way as will facilitate the growth of the dried bacteria, and to delay or prevent the development of the forms which might be induced from the outside. Consequently, two packets of nutrient salts have been distributed with the cotton culture; one containing sugar, magnesium sulphate, and potassium phosphate, and the other ammonium phosphate. By the addition of the first three ingredients to the water containing the cotton saturated with bacteria, a solution is formed which is not well adapted for the organisms usually carried about in the air, but is well suited for the multiplication of the nodule-forming bacteria. The addition of the ammonium phosphate at the end of twenty-four hours tends to increase still further the growth of these bacteria, which are already well started if the temperature has not been low or too high."

Experiment with Field Peas.

In June last a quantity of this culture was prepared and forwarded by Mr. Guthrie, of the Agricultural Department, from the United States Department of Agriculture, for inoculating the soil for peas. The solution was cloudy when received, and the experiment was proceeded with at once. In order to test its efficacy or otherwise for field use, a piece of very poor, hungry, sandy ground was selected in No. 1 paddock, which was well drained, and had not grown a leguminous crop of any description since it has been under cultivation. Two plots, A and B, each consisting of $\frac{1}{10}$ of an acre, were well prepared—A to be sown without any inoculation, B to be inoculated. The contents of a half-gallon bottle of the nodule-culture was thoroughly mixed with half a cartload of fine sand, placed upon a heavy canvas sheet. The sand was then spread evenly over the surface of plot B, and well harrowed in. Both plots were then rolled. Drills 3 feet apart

were struck out with a hand seed drill, and Suntop field-pea sown with a hand seed-drill, the whole carefully raked over. The peas were sown on the 16th June, and, though they germinated well, did not make much growth,



Nodules on root of Field Peas from treated plot.

Nodules on root of Field Peas from untreated plot.

on account of the strong, dry, westerly winds and hard frosts. The rainfall covering the period the crop occupied the ground (June to November) was only 3·36 inches, made up as follows:—

June ...	64	points.
July ...	·19	,,
August	·11	,,
September	1·34	,,
October	1·08	,,
	3·36	,,

There was nothing in the appearance of either plot that suggested any special treatment, and, as far as the eye could detect, there did not appear to be any difference in the vigour of the plants. Each plot contained thirteen drills, and, for estimating the yield, 1 chain of each was cut and the vines weighed on the 2nd November. They then appeared to have made their maximum amount of growth.

The following are the weights of the individual drills:—

A Plot (not treated). No. of Drill.	lb.	B Plot (treated). No. of Drill.	lb.
1	7½	1	6
2	9	2	3½
3	9½	3	10
4	10	4	9½
5	11½	5	6
6	8	6	10½
7	6½	7	6½
8	9	8	6½
9	5½	9	10
10	4	10	7
11	4	11	6½
12	4½	12	7
13	7	13	5½
Totals	96		94½

The low yields obtained by some of the drills was due mainly to slight inequalities in the land; but, as these were fairly regular throughout the whole experiment, they did not seriously interfere with the results, as the totals from the two plots show.

A dozen plants from each plot were very carefully dug up, and the roots examined for nodules. They were not very plentiful on all the plants; but it was noticed that those on the roots taken from the untreated plots were small and fairly plentiful, whilst those from the treated plot were fewer in number but considerably larger.

Experiment with Tares.

The culture for this experiment was presented by Mr. J. Angus, of Rooty Hill. In this case the seeds were inoculated. The variety chosen was black

Tares treated with Nitrogen culture. Black Tares untreated.

tares. These were thoroughly moistened with the solution, and dried in the shade, then planted in the same way as any ordinary seed. Two plots, consisting of two drills each, were sown in a light-red loam; one treated as above-described, the seed of the other not treated. Sowing took place in June, and all the seed germinated well; but, having the same dry-weather

Nodules on root of Black Tares from treated plot.

Nodules on root of Black Tares from untreated plot.

conditions as the peas, they did not thrive at all well. Two drills, 1 chain long, were cut and weighed from each plot, the photograph being taken immediately beforehand. No perceptible difference was noticeable in the vigour of the plants in this experiment. The following are the results:—

A (treated).		B (not treated).	
No. of Drill.	lb.	No. of Drill.	lb.
1 ..	22	1 ...	25
2 ...	30	2 ...	23
	—		—
Totals	52		48

There is a slight difference in favour of the treated plot. A number of the most promising plants were also carefully dug out, and their roots examined for nodules. There were numbers of small ones present; but, as far as could be judged, there was no appreciable difference between the number and size of those from the treated as compared with the untreated plants.

Summary.

While not drawing definite conclusions from one season's experiment, which was conducted under droughty conditions, it would appear that, whatever results may be obtained in growing plants in inoculated soil, and under specially favourable conditions as regards moisture and temperature, none of these methods can be made use of to any great extent in practical farming. From the farmer's point of view, one important question is whether inoculation will enable certain plants to grow in places where the climatic conditions are unsuitable. A large portion of this State is unsuited for the successful culture of a number of leguminous plants, and it is only in limited areas where our nitrogen-fixing plants may be said to grow luxuriantly. It seems scarcely credible that the introduction of bacteria in the soil can give plants the power to overcome the climate, thrive, and fix supplies of nitrogen from the air. Bacteria of any sort can only live and work in media which contain, in suitable proportions, all the elements of food required by the germs. In soils whose manurial condition is suited for the action of the nitrifying organisms, the nitrifying bacteria are almost invariably present in sufficient numbers. Mild lime, potash, and phosphates are essential to their proper activity. Where these substances are present in the soil, the nitrifying bacteria usually exist in large quantities; but where any of them are absent, or found in insufficient quantity, the application of pure bacterial culture can hardly be expected to do much good. It is also to be remembered that moisture and certain degrees of temperature are absolutely essential for their rapid propagation.

Ducks and Duck Farming.

[Continued from p. 42.]

D. S. THOMPSON,
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VIII.

CROSSING, AND THE EVOLUTION OF THE BREEDS.

Our original duck was the Mallard. A very dark duck with partridge marking, with a most beautiful coloured bird for a mate, the Mallard

Fig. 1.—Light Rouen Drake.
(Campbell Drake).

drake being a profusion of colours. Every year a singular change takes place in the colour of the drake, which is also common in the Rouen, and will also be found in the Fawn Orpington drakes,

when the dark heads will moult out an even colour throughout. The Mallard drakes, and also the Rouen drakes, change so much in colour in moulting that it is with great difficulty that the drake can be distinguished from the duck at this particular time.

There are very few varieties of ducks compared with fowls, and here there is plenty of room for the experimenter in the evolution of

Fig. 2.—Light Rouen Duck.
(Campbell Duck).

new breeds. New breeds in fowls have been synonymous with improvements ; and no doubt the same would follow in duck evolution, the tendency to outcrossing always tending to improve the breeds in hardiness, increased size, and in other ways. The only modern creations, viz., the Buff Orpington and the Blue Orpington, could easily be excelled, as both of these may fairly be classed as fancy-coloured ducks, that is if the standard already laid down for Buff Orpington ducks is generally accepted. This is said advisedly from the fact that, while the standard lays it down and implies that Buff Orpington drakes will have to be exhibited the same colour all over,

including head, we have never seen a drake of that kind of that colour. Is it possible to breed them in numbers without the dark head—is it possible to breed them at all without the dark head and the same time to be a good even fawn colour throughout? We certainly have not bred them many years, but we have never seen

Fig. 3.—Buff Orpington Drake.

a pure-bred Buff buff throughout, only when moulting. We have bred a drake with an even colour head, but he is from our own development from the Indian Runner and Rouen, which can be seen in the plate in this paper. This is a very important reason why it is difficult to beat the plain whites, the Aylesbury, and Pekin, which for size are as yet unbeaten.

If any of our readers go in for developing a new breed in ducks, let it be a duck in which colour and marking will be of little or no consequence.

When the Mallard was taken into domestication the bird was very small, as was also the size of the egg, and the number laid was very few, but these points have been greatly increased in domestication. In domestication the birds soon showed a tendency

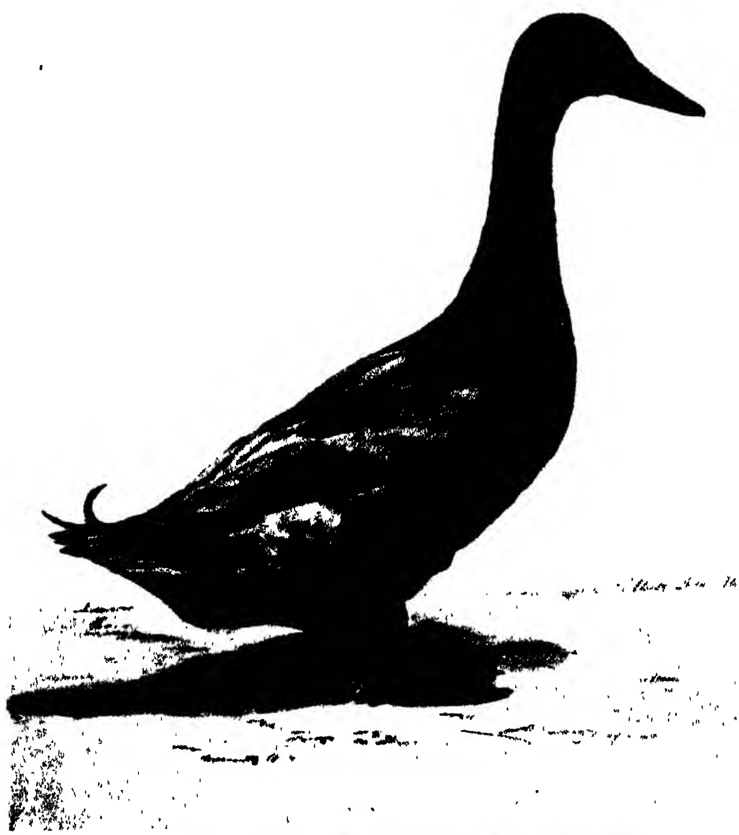


Fig. 4.—Drake. Fawn Indian Runner and Rouen cross.

to vary in colour, and in Europe and Asia the domesticated Mallard sported whites, which have been bred in England for centuries, and in Asia beyond written history. These were the Aylesbury and Pekin. The Mallard, originally about 2 lb. to 2½ lb., was improved in size to 4 lb. and 4½ lb., but now the Aylesbury and the Pekin have been improved to 10 lb. and 12 lb. In this paper we give pictures of the two different birds. In one will be seen the ordinary Pekin; this bird weighs 4½ lb. matured, in the other the improved Pekin, called the

Giant Pekin, scaling 11 lb., and the difference is just as great when growing. At three months the respective weights will be 4 lb. and 6 lb., with the same amount of feeding. The Pekin is the hardier bird of the two white breeds, but a cross between the two invariably gives better results for the table, as the cross makes them hardier, and they grow faster.

Mr. Lewis Wright, the great English authority, says: "The heavy weights of 10 lb. and 9 lb. seen at exhibitions are obtained by

Fig. 5.—Indian Runner Drake.

forcing diet, and birds once fed and fattened up are practically worthless as breeding stock afterwards;" but from experience such is not the case, as these giant birds form quite a distinct breed in themselves, and Rankin, of America, has no difficulty in breeding thousands of them up to and beyond these weights, and breeding from them again.

A new duck might be developed from the Aylesbury and Pekin blood, with a dash of Cayuga for colour, which should give a beautiful magpie black-and-white duck, which with no fixed marking would undoubtedly prove a first-class duck, and could be bred to a very

large size, and would also be hardy, and form quite a distinctive breed for out-crossing, and improve the flavour of the meat. We do not wish to detract from the merits due to the originator of the Orpingtons, but as there is "nothing new under the sun," the same applies to the creation or development of the Orpingtons. Just the same as in fowls, the so-named Buff Orpington and Blue Orpington ducks existed many years before their introducer, but the merit of

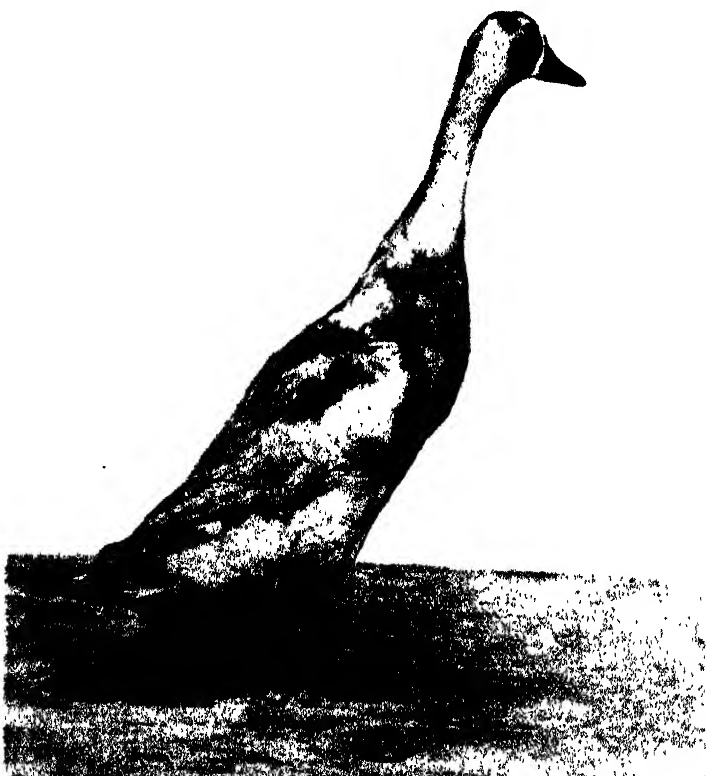


Fig. 6.—Indian Runner Duck.

bringing them before the public as new breeds and as pure breeds certainly is of great importance, and that merit is entirely due to the late Mr. W. Cook, of England.

Fawn ducks and blue ducks exist all over the world in parts wherever duck-breeding goes on indiscriminately, but it required some ingenuity, foresight, patience, and perseverance to bring them out as established breeds. The Black Cayuga, or East Indian duck, must have been bred fairly extensively at one time, as it is undoubtedly from the intermingling of black and white that the blues must

have sprung. Many specimens of blue ducks existed in England long before Mr. Cook started as a poultry-breeder, and we have seen blue and fawn-coloured ducks exhibited in England and Scotland in special classes for any colour. Some districts were notorious for coloured ducks; Lancashire for instance was notorious for blue ducks, while in many of the northern countries of Europe the blue duck is

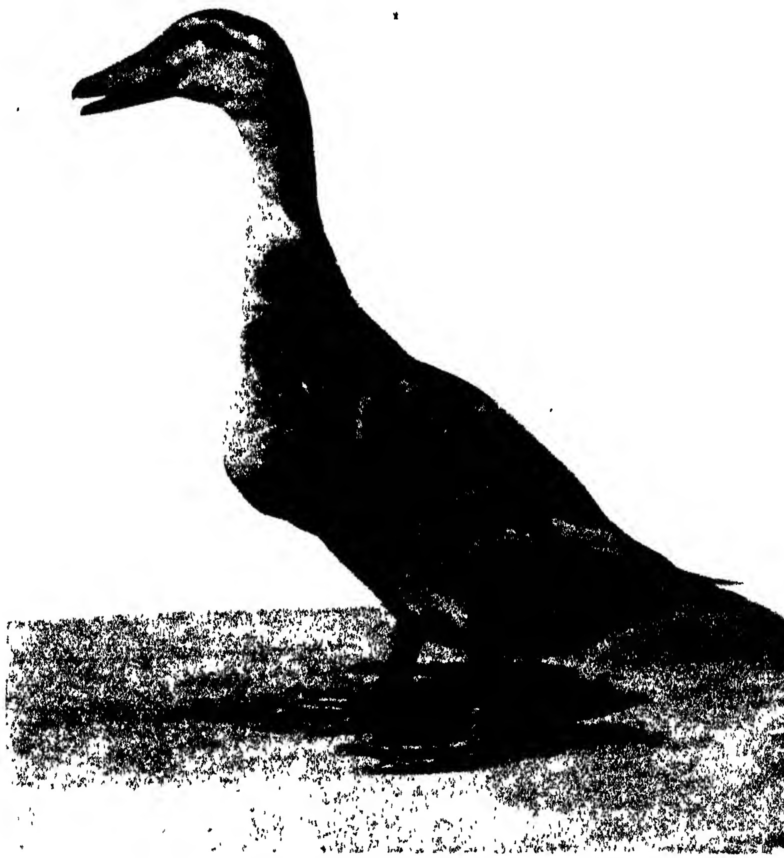


Fig. 7.—Rouen-Indian Runner blood.
(Campbell Duck)

very common. The same with the fawn or sandy-coloured ducks; they are to be found in ordinary farm yards in European countries, but not as selected breeds. There is no doubt that these colours are obtainable from the black duck and the Rouen. In this article will be found a plate of a very light Rouen duck, which would be classed as a Campbell duck in England, from the fact that a Mrs. Campbell has evolved a splendid strain of birds exactly the same as

this duck. This is the duck from which to breed plain fawns or Buffs, as they are misnamed. From this coloured bird, crossed with the Indian Runner, Mrs. Campbell got Buff Orpington ducks or, as she called them, Khaki Campbell ducks, and we have got the same result in colour. The same colour has again been found in

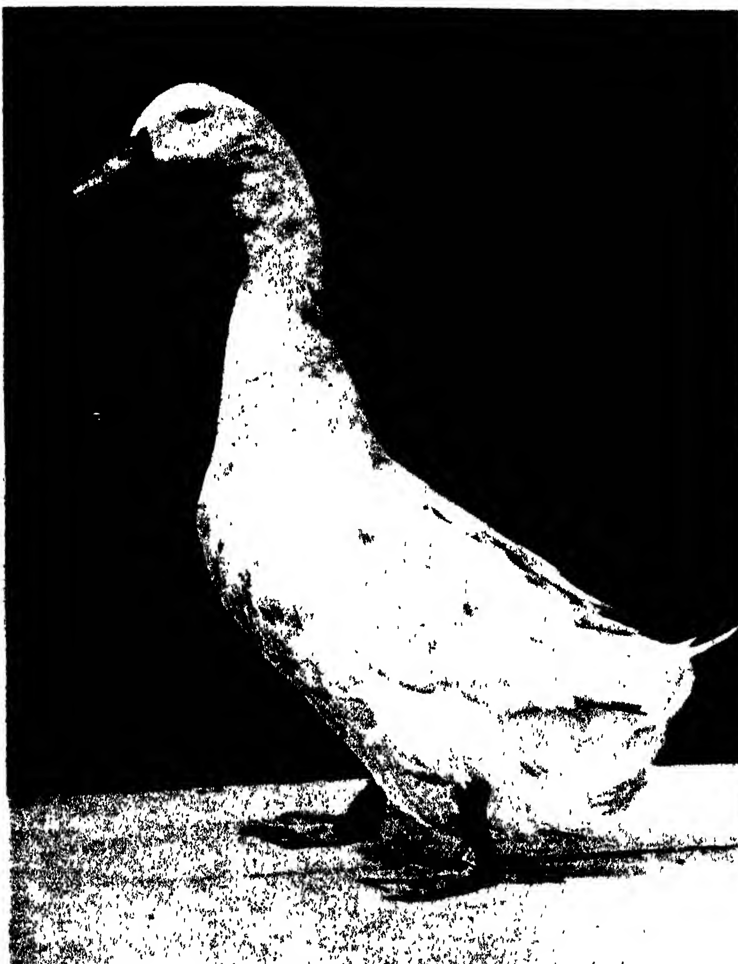


Fig. 8.—Giant Pekin Duck.
Weight at 10 weeks, 6 lb.
" maturity, 9 lb

France, the home of the Rouen, and a duck there called the Duclair is nothing more nor less than a plain colour brown duck bred indiscriminately from the beautifully marked original Rouen. In this connection of colour-breeding we give the illustrations, so that our readers can follow us in colour development. No. 1 is a very light

colour Rouen drake, and No. 2 a very light colour Rouen duck, both of which would pass for a pair of Campbell ducks. Any one can see that, by following up this method of selection, it would be easily possible to produce plain fawn-coloured ducks like the Khaki Campbell duck, or like the so-called Buff Orpington. But by this process of selection they would simply be plain colour Rouen without any outcross of blood. No. 3 shows a pure-bred Buff Orpington drake, bred down from imported blood, and which shows the distinctive

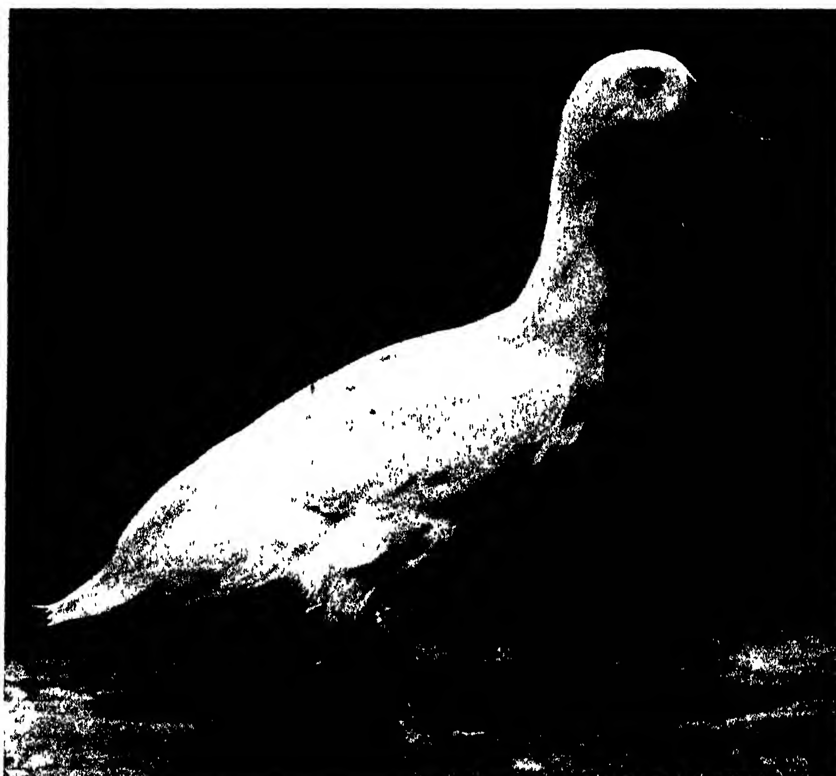


Fig. 9.—Ordinary Market Pekin.
Weight at 10 weeks, 4 lb.
„ maturity, 6 lb.

dark head. No. 4 is a fawn drake produced from light Rouen blood and Indian Runner, and he shows an even coloured head, which shows us distinctly that when the purity of breed is obtained it will be almost impossible to breed without showing the reversion to the Rouen blood indicated in the dark head of the drake. In placing the reversionary indication of dark mantle on the head of the drake, it was not because we wished to see it there that we did so, but simply because our opinion was, and is still, that placing an even coloured

head on a Buff Orpington drake is a fad in colour marking, and all fads should be placed out of court in a utility duck standard. We may be wrong—time will tell; and it will be very interesting to note the number of drakes passed out at the next Royal Show for this fault. The whole of these ducks will prove good blood for the out-

Fig. 10—Buff Orpington Duck.

crossing of Buff Orpington blood. Nos. 5 and 6 are Indian Runners, pure bred, and show the distinctive type from any of the other plain coloured ducks, and No. 7 a first cross Rouen and Runner. When ducks or any other kind of birds sport monstrosities, either in colours, or in shape, or in some distinctive feature, it is easily perpetuated; for

instance, when a five-toed monstrosity was sported, it was easily perpetuated in the Dorking; when a monstrosity was sported with a poll, it was easily perpetuated in the Poland; when a monstrosity was sported with a beard it was easily perpetuated in the Houdan and Faverolles, and so on; and when a white sport sprang from the original dark Mallard, it was easily perpetuated in the Aylesbury and Pekin. Years ago these sports were found, and have been found in recent years. Mr. Charles Ambrose, of Ely, in England, speaking of his experiments in this way, says: "On our fen farms we breed a great many ducks and Mallards, and about seven years ago I managed to get a white Mallard drake, in the same way that a white sparrow, or blackbird or starling, occurs now and again. I put this drake pinioned with two dark Mallard ducks and bred from them, getting only two per cent. white the first year. This year I have got them to breed all pure white, and can now breed any number of pure whites. No. 8 is a Giant Pekin, which at ten weeks weighed 6 lb., and at maturity, 9 lb. No. 9 is the ordinary market Pekin, weighing 4 lb. at ten weeks, and 6 lb. at maturity. While No. 10 is a specimen of the pure bred Buff Orpington duck."

Years ago, in England, when a pure white Mallard was seen in the vicinity, it was put down to have something to do with witchland, and the fen in which it was known to exist was looked upon with superstition.

In Muscovys, we have had white specimens which, when used for crossing, are found to be very prepotent in colour.

To conclude these articles, we give the following pointers on ducks and duck-breeding, original and selected:—

The first eggs of the season have generally a very large percentage of infertiles.

Breeding from first year ducks gives a large percentage of infertiles.

The second and third year are the best for good fertility and good results.

It is a mistake to allow young ducklings an unlimited range.

Ducks can be successfully farmed without ponds, but they must have an unlimited quantity of clean drinking water.

Ducks can be successfully bred from for four or five years.

The colour of duck eggs vary—the greenish tint belongs to the wild Mallard and Rouen, the Aylesbury and Pekin laying generally a white egg.

A duck well hatched is half raised.

The weakest part of a duck is the back.

Ducks can be fed largely on fish, but this gives them a fishy flavour, which is not palatable.

There have been many failures in duck-farming, but the essence of the cause is in the man.

The theory that poultry raising furnishes a nice occupation for little boys and girls, old men and women, and invalids, has long since been exploded.

There is no harder graft than poultry-farming, but you will get well repaid for your work.

There is a good deal of money in poultry-raising, but it takes a big lift to get it out.

A poultry-raiser will never suffer through want of exercise; it is a good medicine for health.

Ducks waste rapidly when in transit, but their recuperative powers are equally wonderful.

Free range is unnecessary for duck yards, 25 x 100 feet, well grassed, will carry 50 ducks.

Duck yards should be laid out so that they can be cultivated. It is a double benefit in healthier stock and better results, also rich crops.

The habit of scalding ducks or any other kind of poultry for ease of plucking is a great mistake, as it hardens the skin, and makes an old duck out of a young one.

Duck eggs can be kept successfully for three weeks for incubation, but a freezing temperature will kill the germ, and also will a heat of 95 to 100 degrees F., if continued for some time.

Young ducks must have plenty of shade; they cannot stand the direct rays of the sun. While old ducks enjoy a good rainfall, young ducklings should be protected from storms.

For young ducklings: see that they cannot get into their drinking water; at the same time see that the water is deep enough to immerse the whole bill, otherwise the nostrils will get stuffed up, and the young ducks will die from asphyxia.

See that your young ducks have plenty of sand to eat. Some say mix the sand in the feed; we say don't.

Feed little and often.

Keep them dry outside by not letting them get wet, and keep them wet inside by giving them plenty of clean drinking water.

Separate the sizes. The big ones will knock the little ones over on their backs, which often kills them, as once on his back, a little duckling has a terrific struggle to right himself again, and if the ground is at all sloppy he would never again get on the right side.

On a dairy farm, ducks will be found profitable consumers of skim milk, and compare favourably with profit from pigs.

Duck eggs require one week longer to incubate than hen eggs, viz., four weeks, and Muscovys, one week longer than duck eggs.

The favourite duck of France is the Rouen; of England, the Aylesbury; and of America, the Pekin.

In closing, we must say a few words on the enemies and friends of the poultry farm. We have found the greatest enemies to be rats, native cats, hawks and crows. The hawk will swoop down and lift a chicken or a duckling in broad daylight, and so long as he is unmolested, he will come again and again. The only way to get rid of this enemy is by shooting. Crows are very early risers, and as ducks lay in the night, they are there at the break of day for their breakfast. A great safeguard is in having, as has been previously stated, nest-boxes for the ducks to lay under. Crows will not go inside. The gun is the only enemy of this wily customer, and although he is very cunning, you can generally get a shot at him, if you are always on the alert. Every time you shoot a few of these pests you will be free from them for a time, but they will come again. Rats are terrible enemies, and if not kept under, they have been known to destroy hundreds of chickens or ducklings in a night. They kill one, and return again, and again, until they have killed the whole batch. The domestic cat is the best enemy of this vermin, and will keep them for ever at bay. A domestic cat in a poultry yard wants to be well looked after, and well fed, and she is worth her tucker every time, for depend upon it, where you have a poultry farm and plenty of feed stored, you will soon find you will have rats when you part with your cat. Feed your cat well, keep a vigilant watch, and immediately pick up all dead chickens and ducklings, and burn them, or you will only teach your hungry cat to eat them, and when she changes her mind to have a live chick instead of a dead one, you will be surprised, but you will only have yourself to blame, and want to drown the poor cat, which you practically drove to it by trying to make her live on the wind. Native cats are terrible scourges, although, as a rule, they only take one at a time; but they are pretty constant. They have no cunning, and directly you know they are about, and which part of the farm they are frequenting, you can trap them very easily, and by constantly setting your traps you can soon rid your farm of this pest for a season. But do not throw away your traps; lay them carefully aside, as they will come again at another season, and unless you are prepared for them they might play severe havoc before you got new traps made. The trap is the enemy of the native cat.

Monthly Weather Report.

HAWKESBURY AGRICULTURAL COLLEGE.

Summary for December, 1905.

Air Pressure (Barometer).			Shade Temperature.				Air Moisture Saturation = 100.			Evaporation (from Water Surface).			
Lowest.	Highest.	Mean.	Lowest.	Highest.	Mean.	Mean for 13 years.	Lowest.	Highest.	Mean.	Most in a Day.	Total for Month.	Monthly Mean for 8 years.	% of the year's Evaporation.
29·62 10th.	30·21 28th.	29·97	50·2 6th.	105 0 26th.	68·9	72·14	40 3, 10.	100 16th.	66	·458 10th.	5 765	6·16	13·7

Rainfall														Total,	Mean rainfall for 13 years.
Dates	1	2	6	7	8	14	15	16	17	28	29	30	31		
Points	50	12	11½	10	6	2	18	10	½	8	1	10	45	184 points.	2·77 points.

Wind ...	N	NE	E	SE	S	SW	W	NW
	3	15	1	4	5	6	3	1

Thunderstorms on dates—2nd, 7th, 14th, 15th, 31st.

Greatest daily range of temperature, 52·9—26th.

Extremes of rainfall—$\frac{0·923}{1901}$ $\frac{7.140}{1903}$

Days on which shade temperature rose above 90° F.— $\frac{9}{90·8}$ $\frac{19}{96·4}$ $\frac{24}{100·2}$ $\frac{26}{105}$ $\frac{30}{94·8}$

Remarks.—A cloudy month. Temperature below the average, evaporation from water surface below.

Summary for the Year 1905.

	Shade Temperature. Maximum.	Minimum.	Mean.	Rainfall.	Evaporation.	Barometer. Mean.
January	111·0	47·4	75·933	·963	6·479	30·009
February	101·5	51·34	71·610	1·049	5·134	30·05
March	96·4	50·2	69 938	3·547	4·333	30·11
April	79·2	40·0	63·706	3·958	2·388	30·23
May	79·5	36·8	56·809	3·390	1·952	30·06
June	72·5	23·8	50·773	·647	1·841	30·12
July	75·4	24·1	46·8	·195	1·906	30·05
August	79·4	25·8	50·448	·110	2·552	29·99
September	79·6	25·5	53·163	1·450	3·979	29·99
October	87·6	31·8	58·622	1·095	4·608	29·91
November	104·9	34·8	69·440	1·812	6·701	30·008
December	105·0	50·2	68·964	4·740	5·765	29·97
			For year, 61·351	22·946	47·638	

	1905.	Highest, in 1902.	Lowest, in 1905.
Mean yearly temperature	61·351	63 120	61·351

Evaporation from a water surface for the year...... .... 47·638 inches.
Highest for any year, in 1901 .... 47·774 ,,
Lowest ,, ,, 1900 .... 43·343 ,,
Rainfall :—Total for year.................................. 22·946 ,,
Mean for 26 years .... 31·447 ,,
Highest for any year, 1892 .... 50·242 ,,
Lowest ,, 1902 .... 19·150 ,,
College records commenced 1893.

A dry year, the winter being exceptionally dry, August giving the lowest month's rainfall recorded here. This year gives the lowest mean temperature recorded here.

CHAS. T. MUSSON,
Observer.

Cold Storage, with Special Reference to the Pear and Peach.

THE successful storage of meat, butter, and eggs for considerable periods is now an established industry; it only requires the delivery at the cold stores of these commodities in a fresh state, and the keeping of them is purely a matter of the person in charge having the necessary experience and control of the temperature.

With fruit, however, greater difficulties present themselves, but it is safe to say that in the near future these difficulties will be overcome, whereby the period over which our most luscious fruits are available will be considerably extended, and the supplying of other markets may then be possible.

It is hardly to be expected that fruit that has been exposed for sale in markets, in an atmosphere more or less impregnated with the germs of decay, will ever give satisfactory results in cold storage, no matter what care in the handling has been taken or how the temperature may be regulated. Throughout the experiments detailed in the following account, which is extracted from "Bulletin No. 40" of the United States Department of Agriculture, by Messrs. G. Harold Powell and S. H. Fulton—the fruit, after being picked and packed, was placed with as little delay as possible in cold storage. The importance of this latter condition becomes manifest when the possibility of holding over fruit in times of glut is being considered. Many fruit-growers are under the impression that the ripening process is entirely suspended when fruit is in cold storage; this is the greatest mistake—it is only delayed. The cold storage of fruit, as far as present knowledge goes, is only successful when the fruit is picked in proper condition and conveyed with as little heating and delay as possible to the cold chamber.

The function of Cold Storage.

Fruit is placed in cold storage to retard the life processes which, as they progress, cause it to ripen and decay. The ripening goes forward more slowly in low temperatures, but still continues in the lowest temperatures in which the fruit may be safely stored. Fruit is stored also to prevent the rapid spread of fungous diseases which cause its premature decay.

The rapidity of ripening in the storage temperature depends principally on the habit of the fruit, the degree of maturity at which it enters the storage house, and the temperature and other conditions in which it is stored. It is influenced also by other factors during its growth and by the treatment it receives before it reaches the storage house.

The warehouse is expected to supply a uniform temperature of the desired degree of cold through the storage compartments during the storage season.

The warehouseman does not insure the fruit against natural deterioration. He holds it in storage as a trustee, and in that relation is bound to use only that degree of care in the management of the warehouse that a man of ordinary prudence would exert under the circumstances in protecting the goods if they were his private property.

It is frequently assumed that the cold-storage house in some mysterious way levels the differences that naturally exist in the fruits of a given kind, causing all the apples of a variety, for example, to keep alike. No assumption, however, could be more fallacious, and it is probable that no one aspect of the storage business has led to more misunderstandings between the men who store fruit and the warehousemen than this unfortunate impression. Cold storage can not improve the physical condition of fruit, and is in no way responsible for the deterioration that may arise from improper picking, grading, packing, and handling before the storage house is reached.

Fruits of all kinds are profoundly modified by the climate, the soil, the age and health of the trees, and the conditions to which they are subjected during their development, and these acquired differences will manifest themselves in the storage rooms just as they do in normal storage ripening, except that they usually appear later.

Practical difficulties in Pear Storage.

There are many practical difficulties in pear storage. The early-ripening varieties which mature in hot weather, like the Bartlett (Williams's Bon Chrêtien) often "slump" before they reach the storage house, or are in soft condition, especially if they have been delayed in ordinary freight cars in transit. They may afterwards decay badly in storage, break down quickly on removal, or lose their delicate flavour and aroma. When stored in a large package like the barrel, the fruit, especially of the early varieties, often softens in the centre of the package, while the outside layers remain firm and green. Frequently no two shipments from the same orchard act alike, even when stored in adjoining packages in the same room, and the warehouseman and the owner, not always knowing the history of the fruit, are at a loss to understand the difficulty. It has been the aim in the fruit-storage investigations of the Department of Agriculture to determine as far as possible the reasons for some of the pear-storage troubles, and to point out the relation of the results to a more rational storage business.

Outline of Experiments in Pear Storage.

The influence of delayed storage on keeping quality.

Pears ripen much more rapidly after they are picked than they do in a similar temperature while hanging on the tree. The rapidity of ripening varies with the character of the variety, the maturity of the fruit when picked, the temperature in which it is placed, and the conditions under which it has been grown. If the fruit is left in the orchard in warm weather in piles or in packages, if it is delayed in hot cars or on a railroad siding in

transit, or if it is put in packages which retain the heat for a long time, it continues to ripen and is considerably nearer the end of its life history when it reaches the storage house than would otherwise be the case. The influence of delay in reaching the storage house will therefore vary with the season, with the variety, and with the conditions surrounding the fruit at this time. A delay of a few days with the quick-ripening Bartlett in sultry weather might cause the fruit to soften or even decay before it reached the storage house, though a similar delay in clear, cooler weather would be less hurtful. A delay of a like period in storing the slower-ripening Kieffer would be less injurious in cool weather, though the Kieffer pear, especially from young trees, can sometimes be ruined commercially by not storing it at once after picking.

From the experiments with the Bartlett and the Kieffer pears, from which these general introductory remarks are deduced, it was found that the Bartlett, if properly packed, kept in prime condition in cold storage for six weeks, provided it was stored within forty-eight hours after picking in a temperature of 32° F.; but that if the fruit did not reach the storage room until four days after it was picked, there was a loss of 20 to 30 per cent. from softening and decay under exactly similar storage conditions.

The Kieffers stored within forty-eight hours in a temperature of 32° F. have kept in perfect condition until late winter, although there is little commercial demand for them after the holidays. The fruit grown by Mr. Waite on young trees in 1901, which was still hard and greenish-yellow when stored ten days after picking, began to discolour and soften at the core in a few days after entering the storage room, though the outside of the pears appeared perfectly normal. After forty to fifty days the flesh was nearly all discoloured and softened, and the skin had turned brown. The fruit from the older trees on the Derby farm in 1902, which was smaller and finer in texture, appeared to ripen as much as the Waite pears during the ten days' delay. This fruit, however, did not discolour at the core and decay from the inside outward, but continued to ripen and soften in the storage house and was injured at least 50 per cent. in its commercial value by the delay.

The results of the experiments point out clearly the injury that may occur by delaying the storage of the fruit after it is picked, and emphasise the importance of a quick transfer from the orchard to the storage house. If cars are not available for transportation and the fruit cannot be kept in a cool place, it is safer on the trees so far as its ultimate keeping is concerned. It is advisable to forward to storage the delicate quick-ripening varieties, like the Bartlett, in refrigerator cars. The common closed freight car in warm weather soon becomes a sweat box and ripens the fruit with unusual rapidity. The results show clearly that the storage house may be responsible in no way for the entire deterioration, or even for a large part of the deterioration, that may take place while the fruit is in storage, and that the different behaviour of two lots from the same orchard may often be due to the conditions that exist during the period that elapsed between the time of picking and of storage.

The influence of different temperatures on keeping quality.

There is no uniformity in practice in the temperatures in which pears are stored. Formerly a temperature of 36° to 40° F. was considered most desirable, as a lower temperature was supposed to discolour the flesh and to injure the quality of the fruit. The pears were also believed to deteriorate much more rapidly when removed to a warmer air. In recent years a number of storage houses have carried the fruit at the standard apple temperatures, *i.e.*, from 30° to 32° F. Large quantities of Bartlett, Angouleme, and Kieffer pears have been stored in 32° and 36° F. in the experiments of the Department. The fruit of all varieties has kept longer in the lower temperature, and the flesh has retained its commercial qualities longer after removal from the storage house. Bartlett pears were in prime commercial condition four to five weeks longer, Angouleme two months longer, and Kieffer three months longer in a temperature of 32° F.

In the higher temperature the fruit ripens more rapidly, which may be an advantage when it is desirable to colour the fruit before it leaves storage; but the fruit in that condition is nearer the end of its life history and breaks down more quickly on removal to a warm atmosphere.

There is a much wider variation in the behaviour of pears that have been delayed in storage or that are overripe when they enter the storage room at 32° and 36° F. than in pears stored at once in these temperatures. In the higher temperature the fruit that has beeen improperly handled ripens and deteriorates more quickly. The lower temperature not only keeps the fruit longer when it is stored at once, but it is even more essential in preventing rapid deterioration in fruit that has been improperly handled.

The influence of the type of package on keeping quality.

Pears are commercially stored in closed barrels, in ventilated barrels, in tight boxes holding a bushel or less, and in various kinds of ventilated crates. The character of the package exerts an important influence on the ripening of the fruit and on its behaviour in other respects, both before it enters the storage house and after it is stored, though this fact is not generally recognised by fruit handlers or by warehousemen. The influence of the package on the ripening processes appears to be related primarily to the ease with which the heat is radiated from its contents. The greater the bulk of fruit within a package and the more the air of the storage room is excluded from it the longer the heat is retained. Quick-ripening fruits, like the Bartlett pear, that enter the storage room in a hot condition in large closed packages, may continue to ripen considerably before the fruit cools down, and the ripening will be most pronounced in the centre of the package, where the heat is retained longest. The influence of the package, therefore, will be most marked in the hottest weather and on fruits that ripen most quickly.

In the experiments of the Department of Agriculture the Bartlett pears were stored in tight and in ventilated barrels, in closed 40 lb. boxes, and in slat bushel crates. After three weeks in the storage house the fruit that was

stored in barrels soon after picking in a temperature of 32° F. was yellow in the centre of the package, while the outside layers were firm and green. After five weeks in storage the fruit in the centre of the barrel was soft and of no commercial value, while the outside layers were still in good condition. The difference was still greater in a temperature of 36° F., and was more marked in both temperatures in fruit that was delayed in reaching the storage house.

In both the closed 40-lb. boxes and the slat crates the fruit was even greener in average condition than the outside layers in the barrels, and it was uniformly firm throughout the entire package.

There was apparently no difference between the fruit in the commercial ventilated pear barrel and the common tight pear barrel.

With the Kieffer, which enters the storage room in a cooler condition and which ripens more slowly, a comparison has been made (in 1902) between the closed 40-lb. box and the barrel, and while the difference has been less marked the fruit has kept distinctly better in the smaller package.

There is a wide difference of opinion concerning the value of ventilated in comparison with tight packages for storage purposes. No dogmatic statements can be made that will not be subject to many exceptions. The chief advantage of a ventilated package for storage appears to lie in the greater rapidity with which the fruit cools, and the quickness with which this result is attained depends on the temperature of the fruit, its bulk, the temperature of the room, and the openness of the package. The open-slat bushel crate, often used for storing Bartlett pears, with which rapid cooling is of fundamental importance, may be of much less value in storing later fruits that are cooler and which ripen more slowly, and it may be of even less importance to Bartletts in cool seasons.

The ordinary ventilated pear barrel does not appear to have sufficient ventilation to cool the large bulk of fruit quickly,

The open package has several disadvantages. If the fruit is to remain in storage for any length of time, its exposure to the air will be followed by wilting, which, in fruits held until late winter or spring, may cause serious commercial injury. The ventilated package, especially if made of slats, needs to be handled with the utmost care to prevent the discoloration of the fruit due to bruising where it comes in contact with the edges of the slats.

There was little difference in the behaviour of the Bartletts in the closed 40-lb. boxes and the slat crates at the end of five weeks, and it would appear that a package of this size, even though closed, radiates the heat with sufficient rapidity to quickly check the ripening. Therefore the grower who uses the 40-lb. or the bushel pear box for commercial purposes can store the fruit safely in this package, but if the barrel is used as the selling package, and the weather is hot, it is a better plan to store the fruit in smaller packages, from which it may be repacked in barrels at the end of the storage season. While this practice is followed in several storage houses, it is not to be encouraged, as the rehandling of the fruit is a disadvantage. Rather the

use of the pear box should be encouraged as a more desirable package, both for storage and for commercial purposes.

The fruit-package question, as it relates to the storage house, may be summed up by stating that fruits like the Bartlett pear and others that ripen quickly and in hot weather may be expected to give best results when stored in small packages. If the storage season does not extend beyond early winter, an open package may be of additional value, though not necessary if the package is small. But fruits like the winter apples and late pears, which ripen in the fall in cool weather and remain in storage for a long period, should be stored in closed packages to prevent wilting. In such cases the disadvantages of a large package, like a barrel, are not likely to be serious.

The influence of a wrapper on keeping quality.

The life of a fruit in cold storage is prolonged by the use of a fruit wrapper and the advantage of the wrapper is more marked as the season progresses. Early in the season the influence of the wrapper is not so important, but if the fruit is to be stored until late spring the wrapper keeps the fruit firmer and brighter. It prevents the spread of fungous spores from one fruit to another, and thereby reduces the amount of decay. It checks the accumulation of mould on the stem and calyx in long-term storage fruits, and in light-coloured fruits it prevents bruising and the discoloration that usually follows.

Careful comparisons have been made of the efficiency of tissue, parchment, unprinted news paper, and waxed papers, and but little practical difference has been observed, except that a large amount of mould has developed on the parchment wrappers in a temperature of 36° F. A double wrapper has proved more efficient for long keeping than a single one, and a satisfactory combination consists of an absorbent, unprinted news paper next to the fruit, with a more impervious paraffin wrapper outside.

The chief advantage of the wrapper for the Bartlett pear, which is usually stored for a short time only, lies in the mechanical protection to the fruit rather than in its efficiency in prolonging its season. Its use for this purpose is advisable if the fruit is of superior grade and designed for a first-class trade. For the late varieties the wrapper presents the same advantages, and has an additional value in increasing the commercial life of the fruit. It is especially efficient, if the package is not tight, in lessening the wilting.

The influence of cold storage on the flavour and aroma of the fruit.

There is a general impression that cold storage injures the delicate aroma and characteristic flavours of fruits. In this publication the most general statements only can be made concerning it, as the subject is of a most complicated nature, not well understood, and involving a consideration of the biological and chemical processes within the fruit and of their relation to the changes in or to the development of the aromatic oils, ethers, acids, or other products which give the fruit its individualty of flavour.

It is not true that all cold-storage fruits are poor in quality. On the contrary, if the storage house is properly managed the most delicate aromas and flavours of many fruits are developed and retained for a long time. The quality of the late fall and winter apples ripened in the cold-storage house is equal to that of the same varieties ripened out of storage, and the late pears usually surpass in quality the same varieties ripened in common storage.

The summer fruits, like the peach, the Bartlett pear, and the early apples, lose their quality very easily, and in an improperly-managed storage house may have their flavours wholly destroyed. Even in a room in which the air is kept pure the flavour of the peach seems to be lost after two weeks or more, while the fruit is still firm, much as the violet and some other flowers exhale most of their aromatic properties before the flowers begin to wilt.

It is probable that much of the loss in quality may be attributed to over-maturity, brought about by holding the fruit in storage beyond its maximum time; but it should be remembered that the same change takes place in fruits that are not ripened in cold storage, the aroma and fine flavour often disappearing before the fruit begins to deteriorate materially in texture or appearance.

On the other hand, it is certain that the quality of stored fruits may be injuriously affected by improper handling or by the faulty management of the storage rooms. Respiration goes on rapidly when the fruit is warm. If placed in an improperly ventilated storage room, in which odours are arising from other products stored in the same compartment or in the same cycle of refrigeration, the warm fruit may absorb these gases and become tainted by them, while the same fruit, if cool when it enters the storage room, will breathe much less actively, and there will be less danger of injury to the quality, even though the air is not perfectly sweet. The atmosphere of the rooms in which citrus fruits or vegetables of various kinds—such as cabbage, onions, and celery—are stored, is often charged with odours arising from these products, if the ventilation is not thorough. In small houses, in which a single room cannot be used for each product, fruits are often stored together during the summer months, and at this period the storage air is in greater danger of vitiation, since it is more difficult to provide proper ventilation.

The summer fruits, therefore, being generally hot when placed in the storage room, are in condition to absorb the odours which are likely to affect the rooms during the warm season, and as the biological and chemical processes are normally more active in the case of such fruit than in fruits maturing later, the flavours deteriorate more quickly, even in well-ventilated rooms. The fruits that are picked in cool weather and enter the storage rooms in a cooler and less active condition are not in the same danger of contamination.

From the practical standpoint it may be pointed out that summer fruits should be stored in rooms in which the air is sweet and pure. They should not be stored with products which exhale strong aromas, and the danger of contamination is lessened if the fruit can be cooled down in a pure room

before it is placed with other products in the permanent compartment provided for it. For the same reason the winter fruits should be stored in rooms in which the air is kept pure, and preferably in compartments assigned to a single fruit.

The experiments furnish no evidence that the quality deteriorates more rapidly as the temperature is lowered. On the contrary, all of the experience so far indicates that the delicate flavours of the pear, apple, and peach are retained longer in a temperature that approaches the freezing point than in any higher temperature.

The behaviour of the fruit when removed from storage.

There is a general impression that cold-storage fruit deteriorates quickly after removal from the warehouse. This opinion is based on the experience of the fruit handler and the consumer, and in many cases is well founded, but this rule is not applicable to all fruits in all seasons. The rapidity of deterioration depends principally on the nature of the fruit, on its degree of maturity when its leaves the warehouse, and on the temperature into which it is taken. A Bartlett pear, which normally ripens quickly, will ripen and break down in a few days after removal. If ripe or over-mature when removed, it will decay much more quickly, and in either condition its deterioration will be hastened if the weather is unusually hot and humid. In the practical management of this variety it is fundamentally important that it be taken from storage while it is still firm, and that it be kept as cool as possible after withdrawal. It is probably true that all fruits from storage that are handled in hot weather will deteriorate quickly, but it appears to be equally true that similar fruits that have not been in storage break down with nearly the same rapidity if they are equally ripe. The late pears, which ripen more slowly, if withdrawn in cool weather, will remain firm for weeks when held in a cool room after withdrawal. If overripe they break down much sooner, and a hot room hastens decay in either case. The same principles hold equally true with apples. The winter varieties, if firm, may be taken to a cool room and will remain in good condition for weeks or months and retain their most delicate qualities, but in the spring, when the fruit is more mature and the weather warmer, they naturally break down more rapidly.

In commercial practice, fruits of all kinds are often left in the storage house until they are overripe. The dealer holds the fruit for a rise in price, and removes it, not because the price is more satisfactory, but because a longer storage would result in serious deterioration. If considerable of the fruit is decayed when withdrawn, the evidence is conclusive that it has been stored too long. Fruit in this condition normally decays in a short time, but the root of the trouble lies not in the storage treatment, but rather in not having offered it for sale while it was still firm. In the purchase of cold-storage fruit, if the consumer will exercise good judgment in the selection of sound stock that is neither fully mature nor overripe, he will have little cause to complain of its rapid deterioration.

Summary.

A cold-storage warehouse is expected to furnish a uniform temperature in all parts of the storage compartments throughout the season, and to be managed in other respects so that an unusual loss in the quality, colour, or texture of the fruit may not reasonably be attributed to improper handling or neglect.

An unusual loss in storage fruit may be caused by improper maturity, by delaying the storage after picking, by storing in an improper temperature, or by the use of an unsuitable package. The keeping quality is influenced by the various conditions in which the fruit is grown.

Pears should be picked before they are mature, either for storage or for other purposes. The fruit should attain nearly full size, and the stem should cleave easily from the tree when picked.

The fruit should be stored at the earliest possible time after picking. A delay in storage may cause the fruit to ripen or to decay in the storage house. The effect of the delay is most serious in hot weather and with varieties that ripen quickly.

The fruit should be stored in a temperature of about 32° F., unless the dealer desires to ripen the fruit slowly in storage, when a temperature of 36° or 40° F., or even higher, may be advisable. The fruit keeps longest and retains its colour and flavour better in the low temperature. It also stands up longer when removed.

The fruit should be stored in a package from which the heat will be quickly radiated. This is especially necessary in hot weather and with quick-ripening varieties like the Bartlett pear. For the late pears that are harvested and stored in cool weather it is not so important. Bartletts may ripen in the centre of a barrel before the fruit is cooled down. A box holding not more than 50 lb. is a desirable storage package, and it is not necessary to have it ventilated. The chief value of a ventilated package lies in the rapidity with which the contents are cooled, but long exposure to the air of the storage room causes the fruit to wilt.

Ventilation is essential for large packages, especially if the fruit is hot when stored and ripens quickly.

A wrapper prolongs the life of the fruit It protects it from bruising, lessens the wilting and decay, and keeps it bright in colour. A doublle wrapper is more efficient than a single one, and a good combination consists of absorptive unprinted news paper next to the fruit, with a more impervious paraffin wrapper outside.

The quality of a pear normally deteriorates as it passes maturity, whether the fruit is in storage or not, or it is never fully developed if the fruit is ripened on the tree. The quality of the quick-ripening summer varieties deteriorates more rapidly than that of the later kinds. Much of the loss in quality in the storage of pears may be attributed to their over-ripeness. The quality is also injured by impure air in the storage rooms, and the warm summer pears will absorb more of the odours than the late

winter varieties. The fruit will absorb less if cool when it enters the storage room. The air of the storage room should be kept sweet by proper ventilation.

The rapidity with which the fruit breaks down after removal depends on the nature of the variety, the degree of maturity when withdrawn, and the temperature into which it is taken. Summer varieties break down normally more quickly than later kinds. The more mature the fruit when withdrawn the quicker deterioration begins, and a high temperature hastens deterioration. If taken from the storage house in a firm condition to a cool temperature, the fruit will stand up as long as other pears in a similar degree of maturity that have not been in storage.

It pays to store the best grades of fruit only. Fruit that is imperfect or bruised, or that has been handled badly in any respect, does not keep well.

Practical Difficulties in Peach Storage.

Under the most favourable conditions known at present, peach storage is a hazardous business. Before the fruit is taken from the storage house the flesh often turns brown in colour, while the skin remains bright and normal. If the flesh is natural in colour and texture it frequently discolours within a day or two after removal. There is a rapid deterioration in the quality of stored peaches when the fruit is held for any length of time, the delicate aroma and flavour giving way to an insipid or even bitter taste. Sometimes the flesh dries out, or under other conditions it may become "pasty." Dealers in storage peaches frequently sell them in a bright, firm condition, and shortly afterwards the purchasers complain of the dark and worthless quality of the flesh. It has often been noticed that fruit in the various packages in the same room does not keep equally well, some of it ripening and even softening while the fruit in other packages is still firm. In fact, the difficulties are so numerous that few houses attempt to store the fruit.

It has been the aim in the cold-storage investigations of the Department of Agriculture to determine, as far as possible, the cause of the peach-storage troubles, and to indicate the conditions under which the business may be more successfully developed.

Outline of Experiments in Peach Storage.

The investigations have been conducted in the cold-storage department of the Reading Terminal Market in Philadelphia, Pa., with Elberta peaches from the Hale Orchard Company, Fort Valley, Ga., and in the warehouse of the Hartford Cold Storage Company, Hartford, Conn., with Elberta and several other varieties grown by J. H. Hale at South Glastonbury, Conn.

In Georgia the fruit was packed in the Georgia peach-carriers, left unwrapped, and divided into two lots, one representing fruit that was nearly full grown, well coloured, and hard; the other, highly coloured fruit, closely approaching but not yet mellow. Three duplicate shipments were forwarded at different times in the two bottom layers of refrigerator cars, and in each shipment part of the fruit was placed in the car within three or four hours after it was picked, and an equal quantity delayed in a packing shed from

ten to fifteen hours during the day before it was loaded. Equal quantities of each series were stored in temperatures of 32°, 36°, and 40° F. The transfer from the refrigerator car to the storage house was made by waggon at night, the interval between the car and storage varying from two to five hours.

In Connecticut the fruit represented two degrees of maturity, similar to the Georgia shipments, except that the most mature fruit was mellow when stored. This fruit was grown at an elevation of 450 feet, on trees six years old. It was medium in size, firm, highly coloured, and of excellent shipping quality. Equal quantities were wrapped in California fruit paper and left unwrapped, and packed in the Connecticut half-bushel basket, in Georgia carriers, and in flat 20-lb. boxes, holding two layers of fruit. The peaches were forwarded by trolley to the storage house, which was reached in two hours after the fruit left the packing shed. Duplicate lots of all the series were stored in temperatures of 32°, 36°, and 40° F.

General statement of results.

The general outcome of the experiments, both with the Georgia and the Connecticut fruit, is similar and may be summed up as follows:—

The fruit that was highly coloured and firm when it entered the storage house kept in prime commercial condition for two to three weeks in a temperature of 32° F. The quality was retained and the fruit stood up two or three days after removal from the storage house, the length of its durability depending on the condition of the weather when it was removed. After three weeks in storage the quality of the fruit deteriorated, though the peaches continued firm and bright in appearance for a month, and retained the normal colour of the flesh two or three days after removal. If the fruit was mellow when it entered the storage house it deteriorated more quickly, both while in storage and after withdrawal. If unripe it shrivelled considerably.

In a temperature of 40° F. the ripening processes progressed rapidly, and the flesh began to turn brown in colour after a week or ten days in storage. The fruit also deteriorated much more quickly after removal, as it was already nearer the end of its life history. It began to lose in quality at the end of a week.

In a temperature of 36° F. the fruit ripened more rapidly than in 32°, and more slowly than in 40° F. It reached its profitable commercial limit in ten days to two weeks, when the quality began to deteriorate, and after this period the flesh began to discolour.

The fruit kept well in all of the packages in a temperature of 32° F. for about two weeks, after which that in the open baskets and in the Georgia carriers began to show wilting. In the 20-lb. boxes, in which the circulation of air is restricted, the fruit remained firm throughout the storage season.

It is necessary that the fruit be packed firmly to prevent bruising in transit, but if the peaches pressed against each other unduly it was found that the compressed parts of the flesh discoloured after a week in storage. A wrapper proved a great protection against this trouble, especially in the baskets of the Georgia peach-carrier, and in all of the packages the wrapped

fruit retained its firmness and brightness for a longer time than that left without wrappers.

The fruit should be removed from storage while it is still firm and bright. The peach normally deteriorates quickly after it reaches maturity, and the rapidity of deterioration is influenced by the nature of the variety, by the degree of ripeness when removed, and by the temperature into which it is taken. A quick ripening sort, like Champion, is more active biologically and chemically than the Elberta variety, and the warmer the temperature in which either is placed the sooner decomposition is accomplished. It is advisable therefore to remove the fruit while firm and keep it in the coolest possible temperature.

The peaches in the top of a refrigerator car that has been several days in transit in hot weather are sometimes overripe and need to be sold as soon as the market is reached, while at the same time the fruit in the bottom layers may still be firm. The rapidity with which the fruit cools down in the car depends on the care with which the car is iced, and on the temperature at which the fruit enters the car. Fruit that is loaded in the middle of a hot day and that has been picked in a heated condition may be 20 or more degrees warmer than fruit picked and loaded in the cool of the morning. Such warm fruit ripens much more rapidly, consumes more ice in cooling down, and takes longer to reach a low temperature. When the temperature in the top of the car is higher than that of the lower part, the ripening of the upper layers of fruit will be hastened. If the fruit is destined for cold storage, these upper layers, if more mature, should be piled separately, and sold as soon as their condition warrants it. Under these conditions if the fruit from this position is mixed in with the rest of the load it may begin to deteriorate before the remainder of the fruit shows mellowing.

The general principles outlined in former pages for the handling of the Bartlett pear apply to the storage of the peach, except that the latter fruit is more delicate and the ripening processes are even more rapid. Every condition, therefore, surrounding the peach in the orchard, in transit, in the storage house, and at withdrawal must be most favourable. The fruit must be well-grown and well-coloured, but firm when picked. The packing must be done with care to prevent bruising. If the fruit is to be transported in refrigerator cars, it should be loaded soon after picking, and preferably before it loses the cool night temperature. The peaches should be transferred from the cars to the storage house, or from the orchard to the storage house if the latter is near the orchard, in the quickest possible time. The air of the storage room should be kept sweet and pure. The fruit should always be removed to the coolest possible temperature, usually at the end of two weeks, while it is still firm, and it should be placed in the consumer's hands at once.

If the fruit is overripe when picked, or becomes mellow from unfavourable handling before it enters the storage house, it is already in a critical condition and may be expected to deteriorate quickly.

If the conditions outlined are observed in the handling of the peach, it is possible to store it temporarily with favourable results.

From the above it is apparent that a considerable amount of success has been achieved, and with greater knowledge and greater care in handling of fruit, better results may be looked for. A very large quantity of summer fruit is grown within a short distance of Sydney, and with care in picking and packing, and attention paid to the carriage, there is no insurmountable obstacle to the successful keeping of fruit here.

With further reference to this subject the following article from the *Review Horticole d'Algeria* is given, as it affords some detailed information of the successful storage of fruit and vegetables for periods varying from eight weeks to six months in perfect condition.

It has been conclusively demonstrated, after many attempts to discover a perfect method for preserving fruit and vegetables, that by cold treatment it is quite possible to keep them in such a condition that they cannot be distinguished from the fresh products. In consequence, refrigerating establishments are being established everywhere. These conclusions have only been arrived at after years of study, observation, and experiment, but we are now able to determine exactly the best method of conserving each fruit and vegetable.

We have experimented principally on the following fruits:—Peaches, prunes, apricots, cherries, strawberries, gooseberries, pears, apples, bananas, and on vegetables—cabbages, cauliflowers, artichokes, asparagus, mushrooms, and tomatoes. Certain kinds of melons are also very suitable for conservation.

We do not affirm that all these will keep from one year to another, but apples and pears will certainly keep for six months under this treatment, and certain kinds of vegetables much longer. However, there is a certain limit to the duration. That is reached when the fruit begins to lose its quality, taste, or appearance. For fruit, this period begins after eight weeks to six months' storage. Prunes, ten weeks; apricots, two months; cherries, two months; strawberries (all kinds), two months; gooseberries (red and white), six weeks; apples (according to the variety), three to six months; pears, two to six months.

In 1902 and 1903 we exhibited different varities of fruits which had been kept in our experimental chamber. These consisted principally of—

One lot	Duchess pears	... ...	Kept two months.
,,	Butter ,,	... ...	,, six weeks.
,,	Crassanes ,,	... ...	,, two months.
,,	Montreuil peaches	... ...	,, ,,
,,	Montbard ,,	... ...	,, ten weeks.
,,	Reine Claude	... ...	,, two months.
,,	Nectarines ...	... ...	, ,,

All these were left exposed for eight days in the humid temperature of the exhibition. They were then tasted and proved delicious. They were awarded a silver medal. The results were quite as satisfactory for vegetables. The length of time these kept in perfect condition was as follows :—

Cabbages	Six months.
Cauliflowers	Three „
Artichokes	Three „
Asparagus	Two „
Egg-plant	Two „
Mushrooms	Two „
Tomatoes	Two „

To ensure success the following conditions must be observed :—

1. The quality of the fruit and its state of maturity when placed in the cold chamber.
2. Temperature suitable to each product.
3. Hygrometric state of the air.
4. Periodic aeration.
5. Packing and arrangement of the boxes in the cold room.
6. Precautions necessary when brought in and taken out.

1. *Quality of product.*—Usually the fruit is of the best quality. Its price is double and treble even after it has been kept for two or three months. It should be sound, and it is best to gather it before maturity. This rule is almost without exception. It should be carefully handled so as not to become bruised.

2. *Temperature for keeping.*—If this is too low the fruit gets frozen and is spoiled. If too high it hastens maturity and the fruit rapidly decomposes. It should be slowly maturing all the time it remains in the chamber. The progress is infinitesimal, but should advance every day until the fruit is withdrawn from the chamber, when it will possess all the qualities of fresh, ripe fruit. The temperature should be for—

Peaches	$+1°$ C. $= 33·8°$ F.
Prunes, cherries, gooseberries	$+0·5°$ C. $= 32·9°$ F.
Apricots	$+2°$ C. $= 35·6$ F
Apples and pears	$+0·5°$ to $+2°$ C. $= 32·9°$ to $35·6°$ F.

In no case must it be lower than 0° C. or 32° F. A difference of $\frac{1}{4}°$ to $\frac{1}{2}°$ C. does not affect the fruit.

Vegetables—

Cabbages	+ 0·5° C.
Cauliflowers	+ 1° to 2° C.
Artichokes	+ 1° C.
Mushrooms	+ 2° C.

We have preserved asparagus for two months at a temperature of + 1° C., carefully keeping it covered with a damp cloth so as to prevent it shrivelling up.

3. *Hygrometric degree.*—The hygrometer in the chamber should register 50 to 60.

4. *Aeration.*—According to the formation of carbonic acid gas in the chamber the air should be renewed by means of ventilators, which can be regulated so as to admit the air slowly and in sufficient quantities.

5. *Packing and disposal of cases.*—Packing should be done with great care. Delicate fruits, such as peaches, should be packed in beds of cotton wool. Before closing the case a sheet of paraffined silk-paper should be laid on the top. The cases are arranged in tiers. They are placed one above another, leaving between them a space of 1½ to 2 inches in which the air may freely circulate. When all the cases are in the chamber, place them for some hours in the transition room, where the temperature is intermediary between the outside and inside of the keeping chamber. The same course is followed when taking out the fruit. By this means a too abrupt change of temperature, which might affect the fruit, is avoided.

Before the cold chamber receives the products, they pass through the transition chamber, where the air is modified, so as to avoid the direct entrance of the outside air when the keeping chamber is opened. It is used for both fruit and vegetables, and they should remain in it for several hours. The refrigerating apparatus is fixed in the keeping chamber. The cold air is introduced by a special machine and stored, and this permits a constant temperature to be maintained in the chamber when the machine is stopped, the outside waste being repaired from the cold stored in the accumulator. A thermometer with an alarm-bell indicates when the highest and lowest temperatures are reached. When warning is given the machine is stopped or set to work as the case requires. The chamber being isolated the loss is insignificant, and the refrigerating machine need only work at long intervals. By our arrangement the cost of working is very low. Near the accumulator is an apparatus called the "damp absorber." From this the correct hygrometric degree is obtained. A ventilating arrangement permits the chamber to be aired as required.

New Method of Keeping Fruit by the use of Formalin.

[From the *Journal d'Agriculture Pratique.*]

A GOOD method of conserving fruit in as nearly as possible its natural state has been largely sought after for a long time, but whatever means have been employed, a perfect result has not been obtained. One reason is the rapidity with which fleshy fruits ferment and rot under the action—as Pasteur has demonstrated—of various organisms, fungus, and bacteria. Taking this view, and believing that if these micro-organisms could be destroyed, the period during which the fruit can be kept in perfect condition might be considerably prolonged, the English agricultural authorities have instituted a series of experiments under the direction of Jodrell Laboratory, Kew. These have been very successful. The English journal of the Board of Agriculture reviewed them in a recent number (No. 5, August, 1905, "Method of preventing the rapid decay of ripe fruit"). This high authority gives its fullest support to the scheme.

The method which has produced the best results is to immerse the fruit in cold water containing 3 per cent. of trade solution of formalin (40 per cent. of formaldehyde).

There are two methods employed, according as the fruit has a soft pulp or is firm-fleshed, and whether it is eaten whole or not. With the former class, to which cherries, strawberries, grapes, &c., belong, the fruit is plunged into the solution for ten minutes. Then it is taken out and steeped for five minutes longer in cold water, and is finally spread out on a metal strainer, or in any other suitable place, to allow it to drain and dry. In the second case, when the fruit has a peel or skin which is not eaten, it is subjected to the formalin solution only.

The Kew experiments were carried out on five kinds of fruit—cherries, strawberries, gooseberries, pears, and grapes. These had not been specially selected, but were bought in fruit-shops, and in some cases from street vendors.

The following figures show the number of days during which the fruit so treated remained perfectly sound, after an equal quantity of each fruit, non-treated, taken for comparison, had become rotten :—Cherries, 7 days ; strawberries, 4 ; gooseberries, 7 ; pears, 10 ; and grapes, 4. These results apply in every case to fruits which were perfectly ripe at the time of treatment ; but if they are subjected to the process before maturity, they keep just as well, while the normal development and flavour undergoes no more alteration than when the fruit is placed in a refrigerator.

It would have been interesting to know the length of time which elapsed between the beginning and end of the experiment, in addition to the number of days during which the treated fruit remained in good condition longer than the other. The practical English people, having proved that this method of conservation is excellent for their indigenous fruits, are hoping to see their

markets supplied with several delicious varieties of tropical fruits which, under former conditions, has been impossible.

A minute examination of ripe fruit from the West Indies intended for the Colonial Produce Exhibition at the Crystal Palace, clearly showed that the decomposition of the mangoes, for instance, during the journey was entirely owing to mould and fermentation caused by bacteriæ and fungi attacking the outer surface, and not owing to a tendency of the fruit to decay or ripen too quickly. A similar treatment could be profitably employed on a number of tropical fruits which are imported in a good condition (such as bananas), but which often have a dark and disagreeable appearance, caused by an exterior fungus. Pears, apples, oranges, citrons, &c., might all be treated with the same advantage.

In England great importance is attached to this new means of conservation, which is at once very simple, inexpensive, and absolutely harmless. Several other preservatives have been tried, but taking all conditions into consideration—ease of application, smallness of cost, and perfect safety during its application—formalin comes easily first. It is easy to understand why the English, who are the greatest importers of fruit from all parts of the world, should be eager to discover a process for preserving as long as possible its quality and appearance; and it is because of their incontestable and official statements that we think it obligatory on us to bring this new process under the notice of all producers, merchants, and consumers, to whom the preservation of fruit is a daily problem.

But although the use of the preservative is chiefly directed towards the keeping of table fruit, it might be applied quite as advantageously to cider fruit. Many cider apples and pears, in spite of the great resistance of their anatomical structure, as compared with that of the garden varieties, have just as much need of protection. The greatest enemy to cider apples intended to be kept for a long time is rot. It originates in the same way as on eating-apples, and there can be no doubt that the same treatment will produce the same results on similar subjects. We repeat the mode of procedure. Plunge for ten minutes in cold water containing 3 per cent. of formalin. A tub or a cask cut in halves will serve for the purpose of a bath. Take out the fruit, and drain and dry on trays, then place in the storeroom as usual, putting on one side as comparison a lot of the same species and weight which have not been sterilised. The expense of this new method of conservation is quite insignificant, and the profits must be very high if the fruit will keep for some time in a perfect state, as is alleged; and if the treatment can be as successfully carried out with the more delicate garden fruits, it will become of immense importance, and affect every species under the sun.

[NOTE.—If the facts related above are borne out by local experiments, no doubt the treatment will be a great help in the holding of fruits in cool chambers; but even if treated in the manner described, the life of ripe fruit is limited to so many days, the matter of temperature without doubt being an important factor in the sound keeping of the fruit.—ED. *Agricultural Gazette.*]

CASTOR OIL PLANT (RICINUS COMMUNIS L.)

The Cultivation of the Castor-oil Plant.

[Reprinted from a pamphlet, "A Prospective Industry: The Cultivation of the Castor-oil Plant," by Q. ERCOLE, M.D., Sydney.]

THIS study of the castor-oil plant has been made with a view to promoting the industry in this State The writer has been impressed, in his travels in New South Wales and Queensland, by the luxuriant and spontaneous growth of this useful plant Near Sydney, on the shores of Botany Bay, anyone can gather beautiful pods, whose seeds upon analysis have been shown to contain 50 per cent. of oil.

"Familiarity breeds contempt," and therefore the importance of its cultivation has not yet been realised. What is written in this paper is substantially correct, as all the data have been collected from writers who are well-known authorities, and after a thorough investigation, the writer also feels competent to express an opinion on the subject. Some details may want revision, but the conclusions will not be altered. I have to thank Dr. Marano, Italian Consul, for the aid he has given me, and for having allowed me to examine some valuable researches of his of ten years' standing. I also thank Dr. Thos L. Bancroft, of Aderley, near Brisbane, son of the well-known scientist, Dr. Joseph Bancroft, for the kind assistance and information he has given me. There are many others who have taken a deep interest in this matter, and who have rendered me material assistance, and to them also my thanks are due.

What the Castor-oil Plant is.

The castor-oil plant is remarkable for strength and tenacity. It is one of the most prolific, self-feeding and quick-growing *Euphorbiaceæ* to be found in the world: equal to the wildest thistle in power of germination and diffusion: equal to the most pernicious burr in persistency of tenure; but, unlike those pests, profuse and lavish in rendering a return both valuable and marketable. The very land that would be useless if placed under the usual crops, will enrich itself if made to grow the castor-oil plant, and will give uniform and abundant yields, because the plant is homogeneous to this soil and in keeping with this climate; so much so indeed, as to almost induce the belief that it is its natural habitat.

"It thrives in rainy seasons, but does almost as well in dry weather, being providentially supplied with a large amount of natural moisture, which literally pervades every fibre of its stalks and leaves, and which it stores and reserves for its own nutriment when the earth fails to supply enough. Annual in many countries of Europe, where the intense cold withers it, the castor-oil plant becomes perennial in this climate." (Cav. V. Marano, M.D., Consul for Italy, from his studies on the castor-oil plant.)

Baron Von Müller in his "Extra-tropical Plants" says:—". . . easy and rapid growth, copious seeding, early returns of produce render this important plant of high value in the warm temperate zone. Thrives almost in any soil. Can be raised in arid plains without being scorched by hot winds."

Description of the Plant.

The *Ricinus communis*, *Palma Christi*, or simply castor-oil plant is a tree of the nat. ord. *Euphorbiaceæ*, indigenous to India and Africa but extensively cultivated in other countries (West Indies, France, Italy, Spain, Southern United States). It is a hardy plant, and thrives alike on the plain and the mountains. Its duration and the size attained by the plant, vary very much in different countries; while it is an annual reaching only a moderate growth in cool climates, in hot countries it becomes a tree, sometimes 20 feet high, often attaining this height in one year from the seed.

Varieties.

There are numerous varieties which have mostly been described as species, but Müller groups them in one species, *Ricinus communis*, Linn.; under 16 varieties. The best known are the *Ricinus sanguineus* which derives its name from the blood-red colour of the stem-leaf stalks, young leaves, and fruit; *Ricinus Borboniensis*, which in the southern climate attains a great height: *Ricinus giganteus*, etc., ete. Some varieties cast their seed too quickly, others too slowly, but those of intermediate character are the best. Dr. Bancroft, of Brisbane, has succeeded, by crossing the white variety, which casts the seed too quickly, with the red, that is so difficult to husk, in producing a good shelling variety.

Soil—where it grows.—Its beneficial influence on poor soil.

The root of this plant being thick and fibrous, a light sandy loam is naturally the best suited to it. Wet, heavy soils are not so adapted: but whether strong or light, the castor-oil plant is considered to be highly fertilising to the soil, and in this respect to surpass clover. A crop of castor-oil beans taken off land in California is considered to enhance its value by several dollars per acre in consequence of the additional fertility imparted to it by the crop; and the belief in the efficacy of this plant as a fertiliser is so strong as to have led to the free lending of land for the purpose of taking a crop of castor-oil beans from it.

Cultivation.

If it is intended to cultivate the crop as a permanent one, the land should be ploughed in ridges of about 8 to 12 feet in width; and seeds sown from 6 to 8 feet apart, on the crown of the ridges. Two seeds should be placed near together so to lessen the risk of failure, and when the plants have attained 6 or 7 inches in height, the weaker may be removed. However the system varies, and no hard-and-fast rules need be laid down, as the cultivation is very simple.

Like many other quick maturing trees, these plants are most vigorous in their early stages of growth, and when cultivated for the seed only they will be found to give the best result by renewing them every seven or eight years.

As regards the seeding, care must be taken to gather the seeds from plants of a known variety, as it is undesirable to have them intermixed, to avoid trouble in gathering.

Harvesting yield.

The seeds of the castor-oil plant are borne by spikelets and are enclosed by a thick pod. When the colour is changing from a reddish hue to a green brown the spikes are cut off and gathered. This work can be done by light labour and can be facilitated by having a vehicle to receive the gatherings of the various operators. A fair day's work for a labourer would be the gathering of 6 to 8 bushels of seeds.

The spikes when gathered are taken to a drying house. Any ordinary frame building can be adapted for the purpose, by constructing a drying floor, composed of battens laid a quarter of an inch apart. As the pods open and the beans are discharged they fall or are swept through the openings between the battens to the floor beneath, whence they are gathered and after being winnowed are bagged.

About 20 bushels of clean seeds (46-48lb. to the bushel) is a small average to an acre. As there are no castor-oil plants cultivated in this country no absolute information can be given. However, the average of 20 bushels to the acre is a very small one. Frequently it reaches 100 bushels to an acre with a yield of 200 gallons of oil. In India the yield is from 15 to 25 bushels to the acre; in California from 30 to 50 bushels. There is no reason why we should not obtain a yield equal to that of the Americans.

Use of Castor-oil Plant and value of its Product.

The leaves of the castor-oil plant are used for feeding a special variety of silk-worm (found in India and Algeria), the hardy *Bombya arrindea.* (The writer is preparing a pamphlet upon this important industry, which should be allied to the castor-oil cultivation) The stem is sometimes utilised for fibre, the quality of which is well spoken of. A considerable quantity of the oil extracted from the seeds is used in medicine; but this is altogether insignificant in comparison with the enormous amount consumed in the manufacture of soaps, as burning oil, in the production of Turkey-red oil, leather oil, as a lubricant, and for other industrial purposes. As a lubricant it is excellent, and in our climate its sluggish action fits it for work where heat acts on the more sensitive oils, and renders them much more costly. The cake resulting from the extraction is a first-class manure, and it is largely used in Southern Europe. Forty bushels to the acre make a good dressing. The fertilising effect is supposed to lie in the farina of the cake and not in the residue of oil or any fatty matter. Recent experiences have also proved that a highly nutritious food for cattle and pigs can be obtained from the cake, after being treated with a neutralising agent to destroy the toxic principle contained in the skin. A product of the oxygenation of castor-oil is a *rubber*, which is at present largely used, and could be easily manufactured. To give an idea of the importance of this trade we shall mention that the value of the 1887 exportation of castor-oil and castor-oil seed from India was about £500,000. At present far more than three times as much is exported from that country alone.

Seeds.

The seeds of *Ricinus communis* are between $\frac{1}{4}$ to $\frac{7}{16}$ of an inch wide and from $\frac{1}{2}$ to $\frac{3}{5}$th of an inch in length; those of tropical countries being larger than those of European growth. The individual seeds are oval, a little flattened on one side, a longitudinal ridge being formed on the other side by a projecting suture. The suture branches dichotomically towards the upper end, and runs below into the brownish pentagonal eye, which is frequently covered by a light brown carruncle bent upwards towards the suture. The shell of the seed is brown, speckled with grey. However, the seeds of some varieties are of different size and colour. The two best known to the oil producer are one bearing large seeds, about the size of a French bean and resembling some varieties of beans in colour, while the other is smaller and of a reddish hue. The small seeded variety has the credit of yielding the best quality of oil and the greatest quantity. But probably there is no difference whatever between the two varieties, the quality and quantity of the product depending wholly on the method of extraction and after-treatment. The seeds contain about 50 per cent. of oil. A leading analyst, having examined a sample of castor-oil seed taken from Brighton-le Sands, reported that the quantity of oil found was 50 per cent. of the weight of the seed.

Oil.—Yields of oil.—Value.

The oil is a liquid almost colourless, transparent, viscid, of faint odour, of bland or slightly acrid taste, neutral reaction, soluble in an equal weight of alcohol. It consists mainly of *ricinolein*, the glyceride of ricinoleic acid, also palmitin, stearin, and myristin, in small quantities, and an acrid principle. The seeds contain also an acrid ferment, *ricin*; and an alkaloid, *ricinice*, which seems to be inert.

In California one ton of seeds gives 100 gallons of oil. The usual return is from 40 to 45 per cent. of the weight of the seeds. However, this quantity varies with the process employed in the extraction. By the cold expression process the yield of oil is from 25 to 30 per cent. (of oil used for medical purposes). By the hot expression process the yield is from 40 to 45 per cent. (lubricating oil, etc.) With an up-to-date oil-press an average of 45 per cent. should be easily reached. If from one acre of land cultivated we obtain 20 bushels of clean seeds (47lb. to the bushel), we should have from 40 to 45 gallons of oil (the gallon of castor-oil being equal to 9·60lb. at 17° C.)

The market price for castor-oil for medical use is 4s. 6d. a gallon; for lubricating oil about 3s. a gallon.

Extraction of oil.

The oil is obtained in various ways, viz., by expression, by decoction, and through the agency of alcohol; but the principal method for the purpose of commerce is expression by hydraulic machines, by means of which the seeds will yield between 45 and 50 per cent. of oil.

Importation and value of the oil imported into the Commonwealth.

These are the returns for castor-oil imported into Australia furnished by the Federal Custom House for 1904 :—

Where from.	Gallons.	Value. £
United Kingdom...	16,403	1,516
Ceylon	1,098	94
Hongkong	80	6
India	427,819	36,721
Straits Settlements	3,187	256
France	89	14
Germany	957	143
Italy	934	97
United States	97	10
	450,654	£38,854

Besides these figures there has been imported a certain quantity of oil in bottles, principally of medicinal castor-oil. The returns for this were not obtainable.

The duty of 6d. a gallon has been paid on 417,821 gallons to the value of £10,445.

Conclusion.

It is quite evident—

(1) That as the importation in the Commonwealth reaches in round figures, duty paid, the sum of £50,000 per annum a wide scope exists for the cultivation of the plant within the States.

(2) The duty of 6d. per gallon, plus freight to Australia from foreign centres of production, ought to give the industry a fair advantage.

(3) The allied industry of the silkworm (*Bombya arrindea*) which lives on the leaves of the plant, and gives a good silk, must be taken into full consideration.

(4) The residue cake, as a by-product, has a considerable value both as a fertiliser and as a food for pigs and cattle.

(5) A product of the oxygenation of castor-oil is a rubber of great commercial value.

(6) The castor-oil plant requires very little cultivation, is not killed by drought or hot winds, and gives a sure, quick and plentiful marketable article. In fact, I have no doubt that once established upon a solid basis, this product will come to stay in Australia, and its progressive development will be a valuable addition to the resources of the country.

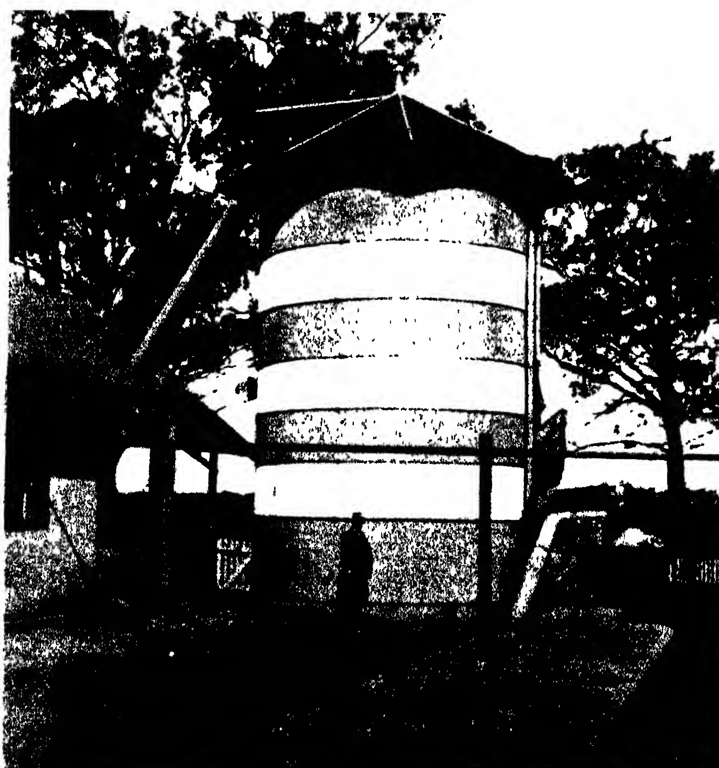
[Note.—The price of castor-oil at present is going up, owing to shortness of the crops in India, the result being that users of castor-oil as a lubricant are looking elsewhere for a cheaper oil to take its place, and are finding it in the mineral lubricants—it is doubtful if machinery men once castor-oil is given up and mineral oil used, will revert to it when the price comes down again; the importations of castor-oil in consequence of the slight rise have fallen off lately to one-half, while the consumption of mineral lubricants is on the increase.—Ed. *Agricultural Gazette.*]

Farm Buildings and Appliances at Newington Asylum.

F. G. CHOMLEY.

The Milking Shed and Silo.

THE modern milking-shed is a very different thing to the old style still unfortunately to be met with on many farms. In the modern shed cleanliness

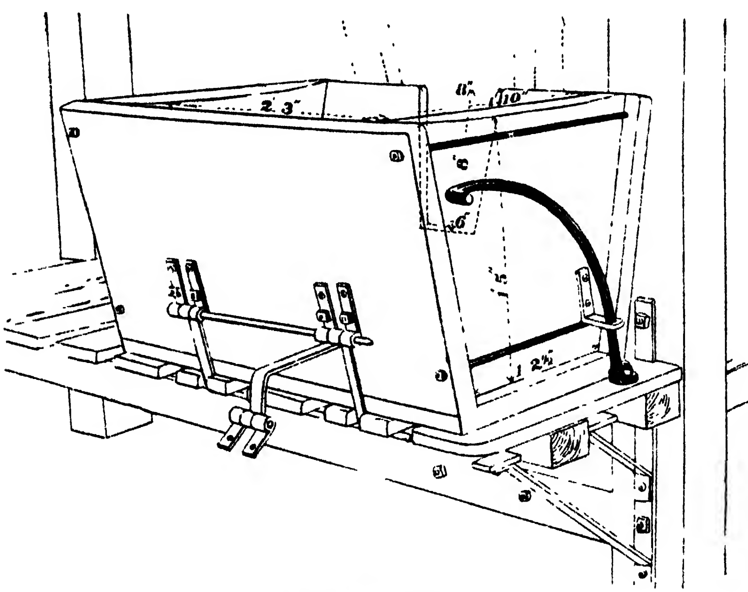


Silo.
Diameter, 16 feet; height, 25 feet; capacity, 100 tons.

and convenience are studied with a minuteness of detail by the progressive dairymen that leaves nothing to be desired. The shed at Newington is a splendid model, and being within easy reach of Sydney, should be seen by those contemplating building a good sanitary and easily-worked shed.

In this shed there are two rows of twenty bails, arranged on either side of a tramway used for the conveyance of feed; at one end is the milk-room and at the other the feed-room, this latter contains a bottle boiler from which hot water is obtainable at any time.

The tramway that runs between the two rows of bails is continued through the feed-room across the yard to the door of the silo; on this runs a large truck, built to tip to either side for the convenience of scooping out the feed, the body of which is made of sheet-iron and is watertight. In this the feed is mixed, damped, and covered with bags and allowed to heat before being fed to the cows. When feeding time comes the truck is run up between the feeding-boxes, and a measured portion placed in each box. This reduces the



Milking-shed Feed Box.

labour of feeding to a minimum, and as there are forty bails and a feed-box to each, every cow has ample time to obtain a proper feed. Between the feed-room and the chaff-house, some little distance away, is an overhead traveller for the conveyance of bagged chaff, bran, &c., this can be seen in the illustration of the silo, where it appears as a single rail about 8 feet from the ground on a downward grade, this is another instance of the regard that has been paid to reducing labour.

The whole of the building has a concrete floor, cemented over, leaving a smooth surface, from the feed-boxes to the outside line of the bails there is a fall of 4 inches to a flat gutter; thus there is no curb or other obstruction for cows to trip or slip on and do themselves serious injury, more especially should they be heavy in calf. There certainly is the advantage at Newington of having a good water supply, which is laid on throughout the shed,

making hosing of the bails and feed-boxes a simpler work than is possible in some less favoured districts; but, even so, the scrupulous cleanliness is most noticeable. A few minutes after the last cow was milked there was no evidence that fifty cows had been fed and milked in the building; not a speck—it might have been just built. In the illustration which accompanies these notes is a very clear view of the excellent feed-boxes, designed by Mr. Megarvey, who kindly supplied the details of their construction. They are built of 1¼ inch kauri pine planed smooth. The boxes are 1 ft. 10 in. across the top, 1 ft. 5 in. deep, and 2 ft. 3 in. long; the sides slope inwards, making the bottom 1 ft. 2½ in. wide. These measurements are inside. Two iron rods go from back to front at each end, with nuts on them, to bind the boxes, and prevent any possible rough usage damaging the joints. The front of the box is cut away, to allow the cow to feed comfortably; this opening is 8 inches deep, 8 inches wide at the top, and 6 inches wide at the bottom. The boxes are set on a stand running the whole length of the shed, 1 ft. 5 in. from the ground; this is just a nice height for cows to feed at, and they can get the boxes quite clean without trouble, very little feed gets spilt, as the depth is sufficient to prevent it. To render the cleaning process both simple and efficient, Mr. Megarvey designed a simple hinge and check-rod, the former is seen quite clearly in the illustration, it having been unscrewed for the purpose of showing how it is made. The curved rod runs through an eye on the box, and prevents the box turning over too far. After feeding, the boxes are upended and hosed out, the dung being swept up and removed previously, then the whole floor is washed down.

It might here be mentioned that the shed is without sides, having a roof and ends only. The south wind is kept off by a high galvanized-iron fence, some distance from the shed; while on the other side, buildings used for various purposes, stables, &c., keep the north wind off. Close to and connected by tram with the shed, is the 100-ton tub silo, built after the pattern of the Hawkesbury College tub silo. Some slight alterations, however, were made by Mr. Megarvey,—the doorway timbers have, in the case of the Newington silo, been made of ironbark. This is a very satisfactory improvement, as the hardwood does not give, and holds the tie-rods well; the bands are slightly heavier, but otherwise the general details are the same; full particulars of which appeared in the *Gazette*, September, 1902. The vertical boards are of Oregon 8 inches wide by 2½ inches thick, grooved to take a thin slip-tongue 1¼ inch by ¼ inch—the roof is of Ruberoid—the illustration shows the truck in position below the shoot. The open building on the left contains the corn cutter, from which the elevator proceeds. The Newington silo, with cutter and elevator complete, cost £72, and is alleged to have saved its cost twice over in one season.

Boar Help or Breeding Crate.

This is a most necessary adjunct to the pig-farm; the illustration gives a very good idea of the one in use at Newington; there are many designs of these structures, each farmer having to make use of material at hand. In the case of the one under review, which was built at the Asylum from odds

and ends, the large adjusting screw which regulates the vertical adjustment of the feet-rests is part of an old mangle, while the screws to close the foot-rests on the sow's side, are ordinary smith-made bolts with an extra length of thread working through iron-plates screwed on the side of the structure;

Boar Help.

Length, 6 ft. 6 in., width, 2 feet, height, 6 feet.

there is a door at either end. There is generally enough scrap-iron and screws about a farm, that with a few battens and uprights, could easily be adapted to make a similar contrivance.

Report from the Agent-General.

Fruit Trade with Hull.

The Honorable the Secretary for Mines and Agriculture has received, through Mr. T. A. Coghlan, the Acting Agent-General for New South Wales, the following joint letter from Messrs. White and Son and two other firms of fruit brokers in Hull, together with specimen form of account sales:—

The Agents-General of the Australian Colonies.

"Gentlemen,

"Referring to the privilege we had of waiting upon you as a deputation, on the occasion of your recent visit to Hull, we have now pleasure in submitting, as requested, the following particulars with regard to the prospects of the sale of Australian and Tasmanian apples in this market.

"As you are aware, by reason of its geographical position, Hull is the natural port for the large district from Newcastle on the north to Lynn on the south and Birmingham on the west, a triangular area, containing a large population of over ten millions, and embracing the densely-populated and large wage-earning districts of the West Riding of Yorkshire, and the iron and coal country of the North of England.

"The port charges of Hull, and the railway rates from hence to the districts mentioned compare favourably with those of any other port, whilst frequent and regular lines of steamers plying from Hull to Leith, Dundee, Aberdeen, Boston, Yarmouth, and also to Continental ports, give additional importance to Hull as a distributive centre. This proximity to the Continent also renders Hull, possibly, the most important centre for the distribution of summer fruits, this fact, in itself attracting a regular attendance of most of the leading fruit merchants in the north of England.

"There is a good opening here for your apples, because of the comparatively small supply now being landed here. Indeed, so far as apples are concerned, Hull is very inadequately supplied, owing to the absence of any regular lines of properly equipped steamers from the apple-growing countries, in proof of which we may cite the fact that, whilst one-fourth of the total imports of hard fruits into Liverpool and London consist of American and Canadian apples, these goods only comprise one-fifteenth of the total imports into Hull.

"It will thus be seen that buyers catering for over ten million inhabitants, in addition to the requirements for the continent of Europe, for all of whom Hull is the natural market, and which buyers attend Hull regularly to purchase fruit, are compelled to supply their requirements of apples in either Liverpool or London, with consequent heavier railway rates and loss through deterioration during transit.

"We are confident that all varieties of apples shipped from your colonies would meet with an excellent market here, but are of opinion that the coloured fruits are most in request in the districts named, but to amplify, the following are the favourite varieties:—

Adams's Permain.	Newtown Pippins.
Scarlet ,,	Scarlet Nonpareil.
Sturmer Pippins, large.	Hoover.
,, ,, medium.	Cox's Orange Pippins.
New York Pippins, or Cleopatra.	French Crabs.
	Crow Eggs.
Ribston Pippins.	Blenheim Pippins.
Alexandra.	Gravenstein.

"We should add that we, the under-mentioned firms, have been established in Hull as fruit brokers, for a large number of years, and are thoroughly conversant with all the requirements of the trade. We hold public sales twice or three times every week, and, practically, the whole of the hard fruit, such as oranges, lemons, grapes, &c., passes through our hands.

"We need not remind you that the fact of our sales being public, and each parcel of fruit being duly catalogued, together with the standing position of our firms, is the best guarantee your shippers can have that they receive the actual proceeds of their consignments.

"In the event of it not being possible to arrange for direct steamers during the coming season, we suggest that transhipment of trial consignments should be made to this port from London. The rates for each transhipment are by steamer about 11s. 8d. per ton, by rail about 28s 7d. per ton, but it is quite possible that for larger parcels special terms might be obtained from the carriers.

"In conclusion, we have pleasure in handing herewith *pro formâ* account sales, showing our charges, *i.e.*, for prompt sales. In the event of shippers desiring and instructing us to hold for any length of time, additional warehouse charges would necessarily be incurred.

"Trusting that these particulars will embrace all the information you require, and placing our services at the disposition of the shippers."

We are, &c.,

W. LAMBERT WHITE,
Director.
(For White and Son, Limited.)

E. AND J. SHAW.

JOHN SEED AND SONS.

[*Copy of pro formâ Account Sales.*]

Account Sale of Boxes Australian and Tasmanian Apples,
ex steamers at
Sold by order and for account of

			£	s.	d.
Gross Proceeds as per Catalogue					
Less Freight on as paid at per					
Our Charges					
Landing, Warehouse & Sale Expenses, &c., at 4d. per Box					
Cartage at per					
Brokerage 2%					
Commission & del Credere on £ at 3%					
E. & O. E. Hull, Nov. 8th, 1905.	*Net Proceeds*	£			

Honey in England.

The Acting Agent-General for New South Wales, in London, reports that the principal sources of supply for imported honey into the British market are Jamaica, California and Chili. The average importations annually amount to about 1,000 tons, of which about 530 tons come from Chili, and the rest in small lots from various sources. A few years back Chili used to contribute a very much greater proportion of the trade, and in 1901, which was marked by the greatest importation of honey for many years, Chili supplied 586 tons of the total of 1,535 tons, Jamaica being next with 450 tons. London is the principal distributing centre for Great Britain, the bulk of imports being consumed at home, though shipments are also made to all parts of the Continent. The chief characteristics necessary to render honey suitable for the British market are flavour, colour, and clearness, flavour being the most important. The best honey should be sweet and clean in flavour, and "pale set clear" in appearance.

Amber honey is the next in grade, and brown honey is regarded as inferior. Honey is used in England both for manufacturing purposes and as a table delicacy. California is the chief source of supply (outside Great Britain itself) for table honey, and it comes packed in cases, which are considered more suitable for this class of trade. Jamaica honey is chiefly used for manufacturing purposes, and for this branch the most suitable packages are kegs and barrels containing 2 to 3 cwt. each. A certain proportion of Jamaica honey also comes packed in cases for table use. Australian is only used, generally speaking, for certain manufacturing purposes, on account of the peculiarity of flavour.

The present prices of honey are:—Finest, 20s. to 25s. per cwt.; ordinary, 14s. to 18s. The higher range of prices would be for the finest table honey, and the lower range would represent the price of the ordinary commercial article. These prices are considered moderate, and somewhat below the average. Much of the Jamaica honey is sold at 17s. to 18s. per cwt. Australian is regarded by the principal dealers here as being worth 5s. less per cwt. than Jamaica; and under these circumstances there does not appear to be much scope for our honey in Great Britain, unless it can be sent over at a cost of not more than 12s. per cwt., including all charges.

Regarding the prejudice against Australian honey, this feeling is apparently a deep-rooted one, and it is quite possible that it is based on the experience of mixed or inferior samples which have reached England. If some of the excellent "box" honey produced in many parts of New South Wales could be sent here, the bad impression might be removed.

Report from the Commercial Agent for South Africa.

Angora Goat and Ostrich Farming.

Mr. Valder, The Commercial Agent for South Africa, reports as follows —

I notice, according to the Sydney newspapers, that considerable interest is being taken in New South Wales of late in Angora goats and ostrich farming. From my experience, I fully believe that both of these industries should be developed in New South Wales. Angora goats do not appear to pay as well as sheep: and in good grass country where sheep thrive, it would be unwise to attempt keeping them, but there are large areas where, in consequence of the thickness of the scrub, sheep do little good and upon such lands the Angora would thrive. I have seen Angoras doing well here upon country that our farmers would consider to be too rough to be of any use, even for grazing. Angoras for breeding could be purchased here very cheaply, but, unfortunately, the Cape Government has lately passed an Act placing an export duty of £100 per head on these animals, and this, practically, makes the price prohibitive. If, however, Angoras from the Cape can be admitted to New South Wales, and it is thought advisable to import some, it would be worth while to see if some arrangement cannot be made for the Cape authorities to allow a number to be exported free of the duty.

Ostriches could, I consider, be profitably kept in many parts of New South Wales. Our warm dry climate is as suitable tor ostriches as it is for Angoras. We should certainly not require to import feathers, and, I believe, that we should eventually be able to compete successfully in the export trade. Our conditions are, practically, the same as those at the Cape both for soil and climate, except that we have the advantage of a

better rainfall, and, therefore, a better supply of food. Like the Angora the ostriches will thrive on very rough scrubby country, and it eats many kinds of shrubs that sheep would not touch. The farmers here often run their ostrich on this rough class of country, and simply irrigate small patches of lucerne and other fodder plants with which to feed them in times of scarcity, and also for feeding to the young birds. There are plenty of places in New South Wales where land of this description could be obtained, and where, I consider, it would be found that ostriches would pay better than any other live stock. Only recently, I visited an ostrich farm where, on 2,000 acres, a farmer was running between 400 and 450 birds, from which, last year, he took feathers to the value of £1,300, *i.e.*, £3 per bird. This land was rough scrubby country, situated in a district having, at the most, 15 inches of rain per annum, and yet, with the aid of a few acres of irrigated lucerne, the farmer was able to keep his birds in splendid condition all the year round. Many ostrich farmers state that they obtain feathers to the value of £10 per bird, but this is only for selected cock birds, and the average of £3 per bird given above is a good one.

Besides the feathers there is a small trade done in the eggs, which are sold for cooking. A cake and biscuit baker at Port Elizabeth told me that he bought up large numbers of the eggs during the laying season, using them for making biscuits and cakes, and that he also stored large numbers in lime-water for use in the off season. The average price given for these eggs was 9d. each, as a rule he was able to sell the blown shells for 3d. each, and therefore, the net cost was 6d. each. An ostrich egg he considered on an average to be equal to about fifteen to eighteen hen eggs, and, therefore, they were the most economical eggs he could use.

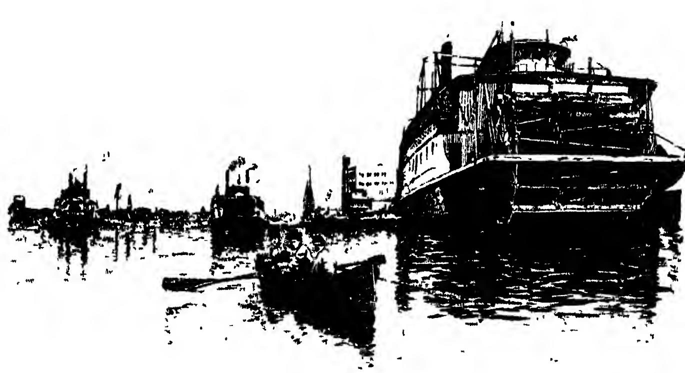
The great difficulty in getting a start with ostriches in New South Wales is the scarcity of the birds, but I believe that they can be purchased at a fairly reasonable rate either in South Australia or New Zealand. With a pair or two of birds one can soon breed up a large flock. In South Africa, the farmer, in some instances, hatches his chicks with the incubator, and also allows the hen ostrich to sit. If the hen is set, the chicks are removed directly they hatch out and are reared by hand. The hen will then soon lay again, and if the process is repeated it will generally be found that some few clutches can be raised in the one season. It is, therefore, possible to obtain a large number of chicks from the one pair of birds in a single season, and thus a good start is quickly made.

Trade in Lucerne.

Mr. Valder, reporting on the prospects of trade in lucerne, says that local fodder is most plentiful there during the summer months, and that the demand for imported fodders is, therefore, greatest in the winter. The seasons there are practically the same as in Australia. The farmers grow considerable quantities of oaten hay and smaller quantities of lucerne. The supplies of local fodder are heavy from October till the end of January, but the summer at the Cape being the dry season, a shortage usually sets in after

the latter month, and the demand for imported fodders usually lasts from then till the end of the winter.

The area under lucerne is gradually increasing, and Mr. Valder is inclined to think that, in the course of a few years, sufficient will be grown for local requirements. There are few places in Cape Colony where lucerne can be grown successfully without irrigation, but many of the farmers are irrigating small patches of lucerne, and there is a general tendency to increase these in situations where the soil is suitable and water can be obtained. Mr. Valder recently inspected an irrigation settlement near Port Elizabeth, known as the Sunday River Estate. At present there is an area of about 1,000 acres under irrigation, and with the extensions shortly to be made this will be increased to 8,000 acres. The whole of the area about to be irrigated is alluvial flat land much resembling our Hunter River flats, but as the rainfall of this district is under 16 inches per annum, little can be done with the land until the water is laid on. At the time of Mr. Valder's visit the greater portion of the 1,000 acres irrigated was under lucerne, and splendid crops were being obtained. The average yield was said to be 1 ton of hay per acre per cutting, and six cuttings per annum had been obtained, *i.e.*, 6 tons of hay per acre per annum. The lowest price obtained for this hay last year was 5s. 2d. per 100 lb. on rail (the railway station being about 5 miles from the estate), and it was said that some of the farmers got as much as 8s. per 100 lb. for a portion of their crop. From this it will be understood that there is every inducement for the farmers to go in for lucerne-growing in suitable situations. As a rule the water supply is not by any means a plentiful one, but there are many places where sufficient can be obtained to irrigate small areas, and as such good prices can be obtained for lucerne hay, there is sure to be a big increase in the number of these put under cultivation.



Diseases of the Horse.

In the June, 1905, issue of the *Gazette* appeared some extracts from a report of the United States Department of Agriculture Bureau of Animal Industry, on the Causes of the Diseases of the Respiratory Organs, by Mr. W. H. Harbaugh, V.S., revised in 1903 by Mr. Leonard Pearson, B.S., V.M.D.; the following extracts are a continuation of that subject:—

The Lungs.

The lungs are the essential organs of respiration. They consist of two (right and left) spongy masses, commonly called the "lights," situated entirely within the thoracic cavity. On account of the space taken up by the heart, the left lung is the smaller. Externally, they are completely covered by the pleura. The structure of the lung consists of a light, soft, but very strong and remarkably elastic tissue, which can only be torn with difficulty. Each lung is divided into a certain number of lobes, which are subdivided into numberless lobules (little lobes). A little bronchial tube terminates in every one of these lobules. The little tube then divides into minute branches which open into the air-cells (pulmonary vesicles) of the lungs. The air-cells are little sacs, having a diameter varying from one-seventieth to one two-hundredth of an inch; they have but one opening, the communication with the branches of the little bronchial tubes. Small blood-vessels ramify in the walls of the air-cells. The air-cells are the consummation of the intricate structures forming the respiratory apparatus. They are of prime importance, all the rest being complementary. It is here that the exchange of gases take place. As before stated, the walls of the cells are very thin; so, also, are the walls of the blood-vessels. Through these walls escapes from the blood the carbonic acid gas that has been absorbed by the blood in its circulation through the different parts of the body; and through these walls is absorbed by the blood, from the air in the air-cells, the oxygen gas which is the life-giving element of the atmosphere.

Congestion of the Lungs.

Congestion is essentially an excess of blood in the vessels of the parts affected. Congestion of the lungs in the horse, when it exists as an independent affection, is generally caused by over-exertion when the animal is not in a fit condition to undergo more than moderate exercise. Very often what is recognised as congestion of the lungs is but a symptom of exhaustion or dilatation of the heart.

The methods practised by the trainers of running and trotting horses will give an idea of what is termed "putting a horse in condition" to stand severe exertion. The animal at first gets walking exercises, then after some time he is made to go faster and further each day; the amount of work is daily increased until the horse is said to be "in condition." An animal so prepared runs no risk of being affected with congestion of the lungs, if he is otherwise healthy. On the other hand, if the horse is kept in the stable for the purpose of laying on fat or for want of something to do, the muscular system becomes soft, and the horse is not in condition to stand the severe exertion of going fast or far, no matter how healthy he may be in other respects. If such a horse be given a hard ride or drive, he may start off in high spirits, but soon becomes exhausted, and if he is pushed he will slacken his pace, show a desire to stop, and may stagger or even fall. Examination will show the nostrils dilated, the flanks heaving, the countenance haggard, and the appearance of suffocation. The heart and muscles were not accustomed to the sudden and severe strain put upon them; the heart became unable to perform its work; the blood accumulated in the vessels of the lungs, which eventually became engorged with the stagnated blood, constituting congestion of the lungs.

The animal, after having undergone severe exertion, may not exhibit alarming symptoms until returned to the stable; then he will be noticed standing with his head down, legs spread out, the eyes wildly staring or dull and sunken. The breathing is very rapid and almost gasping; the body is covered with perspiration in most cases, which, however, may soon evaporate, leaving the surface of the body and the legs and ears cold; the breathing is both abdominal and thoracic; the chest rises and falls, and the flanks are powerfully brought into action. If the pulse can be felt at all it will be found beating very frequently, one hundred or so to the minute. The heart may be felt tumultuously thumping if the hand is placed against the chest behind the left elbow, or it may be scarcely perceptible. The animal may tremble all over the body. If the ear is placed against the side of the chest a loud murmur will be heard, and perhaps a fine crackling sound.

One can scarcely fail to recognise a case of congestion of the lungs when brought on by over-exertion, as the history of the case indicates the nature of the ailment. In all cases of suffocation the lungs are congested. It is also seen in connection with other diseases.

Treatment.

If the animal is attacked by the disease while on the road, stop him immediately. Do not attempt to return to the stables. If he is in the stable, make arrangements at once to ensure an unlimited supply of pure air. If the weather is warm, out in the open air is the best place, but if too cold let him stand with head to the door. Let him stand still; he has all he can do, if he obtains sufficient pure air, to sustain life. If

he is encumbered with harness or saddle, remove it at once and rub the body with cloths or wisps of hay or straw. This stimulates the circulation in the skin, and thus aids in relieving the lungs of the extra quantity of blood that is stagnated there. If you have three or four assistants, let them rub the body and legs well, until the skin feels natural; rub the legs until they are warm, if possible. When the circulation is re-established, put bandages on the legs from the hoofs up as far as possible. Throw a blanket over the body and let the rubbing be done under the blanket. Diffusible stimulants are the medicines indicated—brandy, whisky (or even ale or beer if nothing else is at hand), ether, and aromatic spirits of ammonia. Two ounces each of spirits of nitrous ether and alcohol, given as a drench diluted with a pint of water every hour until relief is afforded, is among the best remedies. Or, give a ¼ of a pint of whisky in a pint of water every hour, or the same quantity of brandy as often, or a quart of ale every hour, or 1 oz. of tincture of arnica in a pint of water every hour until five or six doses have been given. If none of these are at hand, 2 oz. of oil of turpentine, shaken with a ½ pint of milk, may be given once, but not repeated. The animal may be bled from the jugular vein. Do not take more than 5 or 6 quarts from the vein, and do not repeat the bleeding. The blood thus drawn will have a tarry appearance.

When the alarming symptoms have subsided active measures may be stopped, but care must be used in the general treatment of the animal for several days, for it must be remembered that congestion may be followed by pneumonia. The animal should have a comfortable stall, where he will not be subjected to draughts or sudden changes of temperature; he should be blanketed and the legs kept bandaged. The air should be pure, a plentiful supply of fresh cold water always in the stall, and a diet composed principally of bran mashes, scalded oats, and, if in season, grass. When ready for use again the horse should at first receive moderate exercise only, which may be daily increased until he may safely be put to regular work.

Pneumonia, or Lung Fever.

Pneumonia is inflammation of the lungs. The chief varieties of pneumonia are catarrhal—discussed in connection with bronchitis, under the name of broncho-pneumonia—and the fibrinous or croupous variety. The latter form receives its name from the fact that the air spaces are choked with coagulated fibrin thrown out from the blood. This causes the diseased portions of the lungs to become as firm as liver, in which condition they are said to be hepatised. As air is excluded by the inflammatory product, the diseased lung will not float in water.

The inflammation usually begins in the lower part of the lung and extends upwards. The first stage of the disease consists of congestion, or engorgement, of the blood vessels, followed by a leakage of serum

containing fibrin from the blood-vessels into the air-passages. The fluids thus escaping into the air-cells and in the minute branches of the little bronchial tubes become coagulated.

The pleura covering the affected parts may be more or less inflamed. A continuance of the foregoing phenomena is marked by a further escape of the constituents of the blood, and a change in the membrane of the cells, which become swollen. The exudate that fills the air-cells and minute bronchial branches undergoes disintegration and softening when healing commences.

The favourable termination of pneumonia is in resolution, that is, a restoration to health. This is gradually brought about by the exuded material contained in the air-cells and lung tissues becoming broken-down and softened and absorbed or expectorated through the nostrils. The blood-vessels return to their natural state, and the blood circulates in them as before. In the cases that do not terminate so happily the lung may become gangrenous (or mortified), or an abscess may form, or the disease may be merged into the chronic variety

Pneumonia may be directly induced by any of the influences named as general causes for diseases of the organs of respiration, but in many instances it is due to neglect. A common cold or sore throat may be followed by pneumonia if neglected or improperly treated An animal may be debilitated by a cold, and when in this weakened state may be compelled to undergo exertion beyond his strength; or he may be kept in bad quarters, such as a badly-ventilated stable, where the foul gases are shut in and the pure air is shut out; or the stable may be so open that parts of the body are exposed to draughts of cold air. An animal is predisposed to pneumonia when debilitated by any constitutional disease, and especially during convalescence, if exposed to any of the exciting causes. Foreign bodies, such as food accidentally getting in the lungs by way of the windpipe, as well as the inhalation of irritating gases and smoke, ofttimes produce fatal attacks of inflammation of the lung and bronchial tubes Pneumonia is frequently seen in connection with other diseases, such as influenza, purpura hemorrhagica, strangles, glanders, &c. Pneumonia and pleurisy are most common during cold, damp weather, and especially during the prevalence of the cold winds. Wounds puncturing the thoracic cavity may cause pneumonia

Symptoms.

Pneumonia, when a primary disease, is ushered in by a chill, more or less prolonged, which in many cases is seen neither by the owner nor the attendant, but is overlooked. The breathing becomes accelerated, and the animal hangs its head and has a very dull appearance The mouth is hot and has a sticky feeling to the touch; the heat conveyed to the finger in the mouth demonstrates a fever; if the thermometer is placed in the rectum the temperature will be found to have risen to

103 degrees F. or higher. The pulse* is frequent, beating from fifty or sixty to eighty or more a minute. There is usually a dry cough from the beginning, which, however, changes in character as the disease advances: for instance, it may become moist, or if pleurisy sets in, the cough will be peculiar to the latter affection—that is, cut short in the endeavour to suppress it. In some cases the discharge from the nostrils is tinged with blood, while in other cases it has the appearance of mucco-pus. The appetite is lost to a greater or less extent, but the desire for water is increased, particularly during the onset of the fever. The membrane within the nostrils is red and at first dry, but sooner or later becomes moist. The legs are cold. The bowels are more or less constipated, and what dung is passed is usually covered with a slimy mucus. The urine is passed in smaller quantities than usual and is of a darker colour.

The animal prefers to have the head where the freshest air can be obtained. When affected with pneumonia a horse does not lie down, but persists in standing from the beginning of the attack. However, if pneumonia is complicated with pleurisy, the horse may appear restless and lie down for a few moments to gain relief from the pleuritic pains, but he soon rises. In pneumonia the breathing is rapid and difficult; but when the pneumonia is complicated with pleurisy, the ribs are kept as still as possible and the breathing is abdominal; that is, the abdominal muscles are now made to do as much of the work as they can perform. If pleurisy is not present there is little pain. To the ordinary observer the animal may not appear dangerously ill, as he does not show the seriousness of the ailment by violence, as in colic, but a careful observer will discover at a glance that the trouble is something more serious than a cold. By percussion it will be shown that some portions of the chest are less resonant than in health, indicating exclusion of air. If the air is wholly excluded the percussion is quite dull, as that elicited by percussion over the thigh.

* The pulse may be counted and its character may be determined at any point where a large artery occupies a situation close to the skin and above a hard tissue, such as a bone, cartilage, or tendon. The most convenient place for taking the pulse of the horse is at the jaw. The external maxillary artery runs from between the jaws, around the lower border of the jawbone, and up on the outside of the jawbone to the face. It is located immediately in front of the heavy muscles of the cheek. Its throb can be felt most distinctly just before it turns around the lower border of the jawbone. The balls of the first and second or of the second and third fingers should be pressed lightly on the skin over this artery when its pulsations are to be studied. The normal pulse of the healthy horse varies in frequency, as follows:

Stallion	28 to 32 beats per minute
Gelding	33 to 38 beats per minute
Mare	34 to 40 beats per minute
Foal, 2 to 3 years old	40 to 50 beats per minute
Foal, 6 to 12 months old	45 to 60 beats per minute.
Foal, 2 to 4 weeks old	70 to 90 beats per minute

The pulse is accelerated by the digestion of rich food, by hot weather, exercise, excitement, and alarm. It is slightly more rapid in the evening than it is in the morning. Well-bred horses have a slightly more rapid pulse than sluggish, cold-blooded horses. The pulse should be regular—that is, the separate beats should follow each other after intervals of equal length, and the beats should be of equal fullness or volume.

By auscultation important information may be obtained. When the ear is placed against the chest of a healthy horse the respiratory murmur is heard more or less distinctly, according to the part of the chest that is beneath the ear. In the very first stage of pneumonia this mumur is louder and hoarser, and, also, there is heard a fine crackling sound something similar to that produced when salt is thrown in a fire. After the affected part becomes solid there is an absence of sound over that particular part. After absorption begins one may again hear sounds that are of a more or less moist character and resemble a bubbling or gurgling noise, which gradually change until the natural sound is heard, announcing return to health.

When a fatal temination is approaching all the symptoms become intensified. The breathing becomes still more rapid and difficult; the flanks heave; the animal stares wildly about as if seeking aid to drive off the feeling of suffocation: the body is bathed with sweat; the horse staggers, but quickly recovers his balance; he may now, for the first time during the attack, lie down: he does so, however, in the hope of relief, which he fails to find, and with difficulty struggles to his feet; he pants: the nostrils flap; he staggers and sways from side to side and backwards and forwards, but still tries to retain the standing position, even by propping himself against the stall. It is no use, as after an exhausting fight for breath he goes down: the limbs stretch out and become rigid. In fatal cases death usually occurs in from ten to twenty days after the beginning of the attack. On the other hand, when the disease is terminating favourably the signs are obvious. The fever abates and the animal gradually improves in appetite; he takes more notice of things around him; his spirits improve; he has a general appearance of returning health, and he lies down and rests. In the majority of cases pneumonia, if properly treated, terminates in recovery.

Treatment.

The comfort and surroundings of the patient must be attended to first. The quarters should be the best that can be provided. Pure air is essential. Avoid placing the animal in a stall where he may be exposed to draughts of cold air and sudden changes of temperature. It is much better for the animal if the air is cold and pure than if it is warm and foul It is better to make the animal comfortable with warm clothing than to make the stable warm by shutting off the ventilation. The animal should have an unlimited supply of fresh cold drinking water from the start. Blanket the body. Rub the legs until they are warm and then put bandages on them from the hoofs up to the knees and hocks. If warmth cannot be re-established in the legs by hand rubbing alone, apply dry ground mustard and rub well in. The bandages should be removed once or twice every day, the legs well rubbed, and the bandages replaced. Much harm is often done by clipping off hair and rubbing in powerful blistering compounds. They do positive injury and retard recovery, and should not be allowed. Much benefit may be derived from hot applications to the

sides of the chest if the facilities are at hand to apply them. If the weather be not too cold, and if the animal is in a comfortable stable, the following method may be tried: Have a tub of hot water handy to the stable door; soak a woolen blanket in the water, then quickly wring as much water as possible out of it and wrap it around the chest. See that it fits closely to the skin; do not allow it to sag down so that air may get between it and the skin. Now wrap a dry blanket over the wet hot one and hold in place with three girths. The hot blanket should be renewed every half hour, and while it is off being wetted and wrung the dry one should remain over the wet part of the chest to prevent reaction. The hot applications should be kept up for three or four hours, and when stopped the skin should be quickly rubbed as dry as possible, an application of alcohol rubbed over the wet part, and a dry blanket snugly fitted over the animal. If the hot applications appear to benefit, they may be tried on three or four consecutive days. Unless every facility and circumstance favours the application of heat in the foregoing manner, do not attempt it. If the weather is very cold or any of the details are omitted, more harm than good may result. Mustard may be applied by making a paste with a pound of freshly-ground mustard mixed with warm water. This is to be spread evenly over the sides back of the shoulder blades and down to the median line below the chest. Care should be taken to avoid rubbing the mustard upon the thin skin immediately back of the elbow. The mustard-covered area should be covered with a paper, and this with a blanket passed up from below and fastened over the back. The blanket and paper should be removed in from one to two hours. When pneumonia follows another disease, the system is always more or less debilitated, and requires the careful use of stimulants from the beginning. To still further weaken the animal by bleeding him is one of the most effectual methods of rétarding recovery, even if it does not hasten a fatal termination.

Another and oftentimes a fatal mistake made by the nonprofessional is the indiscriminate and reckless use of aconite. This drug is one of the most active poisons, and should not be handled by anyone who does not thoroughly understand its action and uses. It is only less active than prussic acid in its poisonous effects. It is a common opinion, often expressed by nonprofessionals, that aconite is a stimulant. Nothing could be more erroneous: in fact, it is just the reverse. It is one of the most powerful sedatives used in the practice of medicine. In fatal doses it kills by paralysing the very muscles used in breathing: it weakens the action of the heart, and should not be used. Do not give purgative medicines. If constipation exists, overcome it by an allowance of laxative diet, such as scalded oats, bran, and linseed mashes, and, if in season, grass. If the costiveness is not relieved by the laxative diet, give an enema of about a quart of warm water three or four times a day.

A diet consisting chiefly of bran-mashes, scalded oats, and, when in season, grass or corn fodder, is preferable if the animal retains an appetite; but if no desire is evinced for food of this particular description, then the animal must be allowed to eat anything that will be taken spontaneously. Hay tea, made by pouring boiling water over good hay in a large bucket and allowing it to stand until cool, then straining off the liquid, will sometimes create a desire for food. The animal may be allowed to drink as much of it as he desires. Corn on the cob is often eaten when everything else is refused. Bread may be tried, also apples or carrots. If the animal can be persuaded to drink milk, it may be supported by it for days. Three or four gallons of sweet milk may be given during the day, in which may be stirred three or four fresh eggs to each gallon of milk. Some horses will drink milk, while others will refuse to touch it. It should be borne in mind that all food must be taken by the horse as he desires it. No food should be forced down him. If the animal will not eat, you will only have to wait until a desire is shown for food. All kinds may be offered, first one thing and then another, but food should not be allowed to remain long in trough or manger; the very fact of it constantly being before him will cause him to loathe it. When the animal has no appetite for anything the stomach is not in a proper state to digest food, and if it is poured or drenched into him it will only cause indigestion and aggravate the case. It is a good practice to do nothing when there is nothing to be done that will benefit. This refers to medicine as well as food. Nothing is well done that is overdone.

There are many valuable medicines used for the different stages and different types of pneumonia, but in the opinion of the writer it is useless to refer to them here, as this work is intended for the use of those who are not sufficiently acquainted with the disease to recognise its various types and stages, therefore they would only confuse If you can administer a ball or capsule, or have anyone at hand who is capable of doing it, a drachm of sulphate of quinine in a capsule, or made into a ball, with sufficient linseed meal and molasses, given every three hours during the height of the fever, will do good in many cases. When the horse is hard to drench give the following:—Pulverised carbonate of ammonia, 3 drachms; linseed meal and molasses (treacle), sufficient to make the whole into a stiff mass: wrap in a small piece of tissue paper and give as a ball. This ball may be repeated every four or five hours. The heart should be kept strong by administering digitalis in doses of 2 drachms of the tincture every three hours, or strychnia 1 grain made into a pill with liquorice powder three times daily.

If the horse becomes very much debilitated, stimulants of a more pronounced character are required. The following drench is useful: Rectified spirits, 3 oz.; spirits of nitrous ether, 2 oz.: water 1 pint. This may be repeated every four or five hours if it seems to benefit; or 6 oz. of good

whisky, diluted with a pint of water, may be given as often, instead of the foregoing.

During the period of convalescence, good nutritive food should be allowed in a moderate quantity. Tonic medicines should be substituted for those used during the fever. Give the following mixture: Reduced iron, 3 oz.; powdered gentian, 8 oz.; mix well together and divide into sixteen powders. Give a powder every night and morning mixed with bran and oats, if the animal will eat it, or shaken with a pint of flaxseed tea, and administered as a drench. If the cough remains after the horse is apparently well, give 1 drachm of iodide of potassium, dissolved in a bucketful of drinking water, one hour before each meal for two or three weeks if necessary. Do not put the animal to work too soon after recovery—allow ample time to regain strength.

The chief causes of death in pneumonia are heart failure from exhaustion, suffocation, or blood poisoning from death (gangrene) of lung tissue. The greater the area of lung tissue diseased the greater the danger, hence double pneumonia is more fatal than pneumonia of one lung.

The Windpipe.

The windpipe, or trachea, as it is technically called, is the flexible tube that extends from the larynx, which it succeeds at the throat, to above the base of the heart in the chest, where it terminates by dividing into the right and left bronchi—the tubes going to the right and left lung, respectively. The windpipe is composed of about fifty incomplete rings of cartilage united by ligaments. A muscular layer is situated on the superior surface of the rings. Internally the tube is lined with a continuation of the mucous membrane that lines the entire respiratory tract, which here has very little sensibility in contrast to that lining the larnyx, which is endowed with exquisite sensitiveness.

The windpipe is not subject to any special disease, but is more or less affected during laryngitis (sore throat), influenza, bronchitis, &c., and requires no special treatment. The membrane may be left in a thickened condition after these attacks. One or more of the rings may be accidentally fractured, or the tube may be distorted or malformed as the result of violent injury. After the operation of tracheotomy it is not uncommon to find a tumor or malformation as a result, or sequel, of the operation. In passing over this section, attention is merely called to these defects, as they require no particular attention in the way of treatment. However, it may be stated that any one of the before-mentioned conditions may constitute one of the causes of noisy respiration described as "thick wind."

Veterinary Notes.

JAS. D. STEWART, M.R.C.V.S.,
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"Ringworm" in Horses.

ALTHOUGH "Ringworm" of a modified or enzootic character has long been known to affect horses and cattle of this State, the outbreak of last autumn proved itself to be remarkably contagious, and appeared to be due to a fungus of exalted virulence.

The disease is caused by a vegetable fungus (*tinea tonsurans*), and while it is readily communicable from horse to horse, it also affects man, cattle, dogs, cats, and other animals.

Horses occupying stalls or loose boxes recently vacated by an animal suffering from ringworm are liable to infection, while the sand-pits in which an affected horse rolls becomes a common source of infection. The chief means of its spread throughout a stable are the saddlery, harness, and stable implements, while careless attendants are by no means of secondary importance.

The disease, fortunately, is very amenable to treatment if taken in time The application of tincture of iodine, a strong solution of sulphate of copper, or a solution of corrosive sublimate (1 in 500) to the affected parts, and thoroughly washing the animal every third or fourth day with a weak solution of any of the carbolic sheep-dipping fluids is usually efficacious.

It is obvious that besides treating the animals, it is also necessary to do away with the source of infection by systematically and energetically disinfecting all and sundry articles with which affected horses have been in contact. To loose boxes and stalls, limewash containing half a pound of unslaked lime to 1 gallon of water, to which is added a cupful of crude carbolic acid, should be applied, while painted woodwork may be effectively cleansed by washing with water containing corrosive sublimate in the proportion of 1 oz. to 3 gallons. Saddlery and harness, and stable implements, should be soaked in a cask containing a fairly strong solution of one of the recognised carbolic disinfectant preparations. Attendants, if caring for more than one horse, should make it a practice to disinfect their hands after touching an affected horse.

Premature Castration of Colts.

Apart from the many influences that have led to the deterioration of stud horses in the State, I desire to draw attention to the pernicious habit of many breeders in castrating their colts too early. Operating on colts when young facilitates their management, but, unfortunately, does so at the expense of their development.

Castration is practised to render the male horse more serviceable for certain purposes, by doing away with undesirable habits and vices of the

stallion, while the good character of the entire animal are retained. The best time, therefore, to castrate horses is between 1 and 2 years of age, when the structural characteristics of the sex are evident. Horses castrated under 1 year old are unsexed before their character has developed, and grow into loosely-made animals with flat sides, narrow chests, and long effeminate-looking heads. They often lack stoutness, courage, and endurance, because these qualities have not had time to become properly developed. Several breeders who used to castrate their horses under 12 months old, acting on my advice, now allow their colts to run entire until they are between 15 and 18 months old, and report that there is a decided improvement in the young stock. With improved castrating instruments, the risk of operating on the older animals is no greater than in castrating 9 months' old colts by means of the obsolete smearing-iron, while the operation is more quickly performed, with less pain to the subject.

Altering Pigs.

"The fact that so many pigs succumb to the operation of castration or suffer from tumours forming in the scrotum after removal of the testicles, is largely due to carelessness and ignorance," says Dr. A. S. Alexander. It is a very easy matter to castrate a young pig, but just as easy to do it wrong. In our experience most of the trouble comes from the use of dirty instruments and rough handling. The knife that is used for tobacco-cutting and is specially sharpened when the time comes to castrate pigs is apt to cause infection. It may be a suitable knife otherwise, but is dirty, and should be thoroughly cleansed before using. Boiling will suffice if that can be done, which is seldom the case. It is, therefore, best to immerse it in a strong disinfectant before use and after operating upon each pig.

The hands should be cleansed with a similar solution, and it is well to use it also upon the parts to be operated upon. As it is, pigs are often taken from a filthy pen and castrated without preliminary washing, and no provision is made to have them occupy a clean, disinfected, and freshly-bedded pen after the work has been done. Pigs should be taken from a clean pen, or washed before operating, and afterwards should go on to a clean pasture-field or into a pen that has been specially prepared by scrubbing, disinfection, and whitewashing.

The next point is to make free incisions in the scrotum. Where small cuts are made, the wounds close too soon and retain blood or pus, and there is also the liability of the cords to become caught between the healing lips of the scrotal wounds, which will surely be followed by the formation of tumours such as we have alluded to. The cords should be severed high, and where this is done and the scrotal wounds are large, there is little danger of tumour formation. Rough handling, and especially dragging upon the cords, increases the liability to tumour and also to ruptures. When a pig is found ruptured in the scrotum at castration time it should be left uncut or castrated by the "covered" method. This consists in cutting through the skin of the scrotum alone, and then inclosing testicles and their envelopes in clamps, which will cause the parts to slough off and leave the sac healed, so that the intestine cannot descend. The same end may be achieved by stitching the envelopes skilfully.—*New Zealand Farmer Stock and Station Journal.*

Orchard Notes

W. J. ALLEN.

FEBRUARY.

THE splendid rains which have fallen during the last two months in the coastal districts have kept the trees and vines growing as well as could be expected of them, and in consequence wherever one goes the young and old trees alike are putting forth strong growth, and the fruit which they are carrying should be of the very best quality and size. Away from the coast some distance the same favourable conditions have not been experienced however, and in many places the heat has been so intense as to have the effect of drying the ground out more quickly than during normal seasons, and as a result there is every danger that unless rain falls before the ripening period the late fruits may suffer. There is no use, however, in meeting our troubles half way, as the warm weather may be the means of bringing rain in time to fill out the later fruits.

In all places where irrigation is practised, see that the trees and vines are kept growing well this month by applying water whenever it is required. After each irrigation, see that the soil is well worked before becoming hard, else the moisture will soon evaporate and the soil will perhaps be in a worse condition than that which had not received a watering. Irrigation and cultivation must go hand in hand, the one being of quite as much importance as the other.

It will be well this month to keep a close watch over all kinds of trees, and wherever scale of any kind is found use every effort to destroy same, either by fumigating or spraying, using any one of the many mixtures which have been found by previous experience to do the best work.

For the destruction of San José scale in deciduous trees, there is no better spray for this season of the year than the resin and soda wash, and for citrus trees fumigation is the easiest means of ridding the trees of all scales; but wherever brown scale or white louse are found in the trees it is best to increase by one-fourth the strength of the charge as given in the fumigating table published about two years back.

Growers who intend to practise fumigation would do well not to treat the trees on hot days but to do the work on cool days, at night time, or in the early mornings and evenings. In measuring the size of the tree, take the extreme height and width before referring to the table to ascertain the quantities of chemicals to use, and be sure not to add the cyanide to the mixture until after the sulphuric acid and water have been put in the bowl or generator, and the latter placed under the tent; then drop in the cyanide and close the tent immediately. Great care must also be exercised not to

allow any of the sulphuric acid to come in contact with either the hands or clothing, as it will make the hands very sore, and if it touches the clothing or tents it will burn holes in them.

Keep the cultivator at work this month, and in this way keep down all weeds, as also the land in a fine state of tilth.

The early part of the present month is the best time to bud to better varieties all poor and worthless varieties of fruit-trees found growing in the orchard. Do not allow an unprofitable tree to remain there another year. Be sure that the buds used are taken from trees that have borne the very best quality of fruit, and do not forget that, in the case of peaches, the good canning varieties always find a ready sale at remunerative prices.

From a photograph of a tare-plant, grown in a Departmental orchard.

Continue fighting the codling moth by picking and destroying all fruit found underneath the trees and seen to be infested with the moth, and give regular attention to the bandages.

Pick up and destroy all fly-infested fruit.

Towards the end of the month, arrangements should be made for sowing leguminous crops, such as are required for green manuring; and as the fall and winter are the only seasons when such crops can be grown among the trees without robbing them of moisture, it is best to sow only such varieties as will make a fair growth during the cooler and cold months. Such crops as gray field peas, tares, &c., are depended on to furnish nitrogen and organic matter to keep the soil in a high state of fertility.

Drying operations will be in full swing this month wherever sultanas, raisin grapes, currants, peaches, and early varieties of prunes are grown. I am pleased to say that at our Wagga orchard all of the above-named fruits are bearing well this year, and we hope to turn out some good samples of the different dried fruits.

The raisin grape intended for lexias, or sultanas, and prunes, all require to be dipped as soon as possible after picking, and before they have been spread on the trays to dry. They should be immersed in a lye made with 1 lb. of caustic soda to 10 gallons of water, when the solution is at boiling point, and allowed to remain in this from one to three seconds, according to the toughness of the skin, as fruit grown on some soils (particularly those of a heavy nature) have thicker and tougher skins than those grown under more favourable conditions, and in consequence are somewhat harder to crack. Therefore, fruits grown on the latter soils may have to be immersed for only one second, while those grown on the heavier soils may require two or even three seconds to have the same effect. All that is required is to produce minute cracks in the skin, which hastens the drying process, but the operator must avoid too long a dip as it will damage the fruit by cracking the skin too much; and also he must keep the lye as near as possible to boiling point.

As soon as the fruit is dipped it should be spread on trays and put out in the sun to dry as soon as possible. It must not, however, be allowed to dry too much before being removed from the trays. It should be quite tough and pliable, and under no circumstances should it be dry enough to rattle. On the other hand, it should be so dry that if squeezed between the thumb and finger, no moisture will exude from it.

I might say that this State imports annually from California and other countries large quantities of both cooking and dessert prunes, which are in no wise superior to those grown here; in fact, all those who sample the dessert prunes put up at our Wagga orchard, claim that they can never buy such fruit in the stores. Also, our sultanas, currants, and dried apricots, are second to none produced in any country in the world. Yet we have only begun to think of growing these fruits, and are still importing large quantities from other States and countries.

I would like if more of those interested in this work could find time to visit either our Wagga, Bathurst, or Hawkesbury orchards during the drying season, in order to see for themselves how the work is done, and the quality of the fruit which we are turning out. Leaflets on fruit-drying may be had on application to the Department of Agriculture.—"Miscellaneous Publication," No. 919.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

Directions for the Month of February.

Vegetables.

February is one of the hottest and most trying months of the year, and, if dry weather and hot winds prevail, it will be a difficult matter to raise vegetables, unless water is available for irrigation. Vegetables need a great deal of water; far more so than would, perhaps, be supposed; and the vegetables themselves are composed chiefly of water. But, even so, irrigation, or the application of water, can be overdone, as may be exemplified in, for instance, a cabbage grown by a Chinaman, and one properly grown by a European.

The prospects of a good moist season for the remainder of the summer are promising, so that those readers who are desirous of growing vegetables will most likely be safe in sowing and planting as extensively as their household requirements demand.

In connection with a vegetable sometimes grown here, but not very frequently, named the Okra (*Hibiscus esculentus*), a pamphlet has lately been published by and received from the Department of Agriculture, Washington, U.S.A., giving some useful information about the plant and its uses, and it is to its uses I should like to refer.

The writer says:—"The principal use of okra is in soups and various culinary preparations in which meats are an important factor, as in the so-called gumbo soups, to which young pods impart an excellent flavour, besides giving a pleasant mucilaginous consistency. The young seeds are occasionally cooked in the same way as green peas, and the very young and tender pods are boiled and served as a salad with French dressing. Both the stem and the mature pod contain a fibre which is employed in the manufacture of paper.

"In countries where large quantities of the pods are consumed, they are dried and preserved, to be used during the part of the year when a fresh supply cannot be obtained. There are several methods of drying the pods. By one of these the pods are cut into slices crosswise and about one-half inch thick; the slices are then spread upon muslin-covered frames and dried, after which the okra is stored in thin bags until required for use. By another and a more common method, the very young pods are strung upon coarse threads and hung up to dry. In Turkey alone there are tons of the pods preserved in this manner each year. A variety much used for drying is that known as *petite gumbo*, or small okra. The pods of this variety are selected when only about one-half inch in

length and of uniform size. These are strung on a string of coarse fibre and hung up to dry.

"No copper, brass, or iron cooking vessels should be employed in preparing okra, as the metal will be absorbed and the pods discoloured or even rendered poisonous. The cooking should be done in agate, porcelain, or earthen ware.

"*Methods of Preparing.*—The following are recipes for a few of the preparations of which okra forms a part. With two exceptions, they are all taken from the Picayune's (New Orleans) Creole Cook-book.

"Okra Soup.—2 pounds of beef, without fat or bone; 2 cups of okra, chopped fine; one-fourth pound of butter; 4 quarts of cold water; 1 onion, sliced and chopped; salt and pepper. Cut the beef into small pieces and season well with pepper and salt. Fry it in the soup kettle with the onion and butter until very brown. Then add the cold water and let it simmer for an hour and a half. Add the okra, and let it simmer gently for three or four hours longer.

"Okra Salad.—Boil the young okra pods whole. When cold, dress with vinegar, salt and pepper, or, if preferred, use plain French dressing, and serve very cold. This is a most delightful summer salad, the okra being very cooling.

"Boiled Okra.—1 quart of young okra; 1 tablespoonful of vinegar; salt and pepper to taste. Wash the okra well in cold water and place in a porcelain or agate saucepan. Add a pint of water and a teaspoonful of salt. Cover the saucepan and let the okra simmer for about half an hour. Place in a dish, season with salt and pepper, pour over the okra a tablespoonful of tarragon vinegar, and set to cool. Serve as a salad with roast meats, etc.

"Baked Gumbo.—Place a thin layer of rice in a baking dish, add a layer of sliced okra, then a layer of sliced tomatoes; add salt, pepper, a little currie, and a small lump of butter. Repeat with alternate layers of rice, okra, and tomatoes until the dish is filled. Cover and bake in the oven until the rice is thoroughly cooked. Remove cover and brown on top. Serve in the baking dish. The rice should be washed in cold water before using, and the okra pods and tomatoes washed and sliced rather thinly.

"*Varieties.*—There are three general types of okra, viz., tall green, dwarf green, and lady finger. Each of these is again divided according to the length and colour of the pods, making in all six classes or varieties, namely, tall green, long pod; tall green, short pod; dwarf green, long pod; dwarf green, short pod; lady finger, white pod; and lady finger, green pod. All variations from these are merely the results of mixtures, no true crosses or hybrids being formed. These mixtures are easily separated and referred to the parent type, and a little attention to roguing and selection is necessary in order to keep the varieties pure. It is essential that the varietal strain should be pure, in order that a uniform and marketable lot of pods may be produced.

"*Summary.*—Okra may be considered a desirable addition to the farmer's garden, and it can be grown in almost any locality. Okra can be produced on any good soil, and the crop requires no special attention other than that which would ordinarily be given a crop of corn or cotton. Plant early in the spring, or as soon as all danger of frost has passed; keep the pods well picked, in order that the plants may not become exhausted by the maturing of the seed, and the pods will continue to be produced until late in the fall. Do not cook the pods in plain iron cooking utensils or in copper or brass. Remember that the taste for the okra flavour has to be acquired by some persons. The varieties of okra best adapted to general use are the dwarf green, long-pod, and the lady-finger ('White Louisiana') types."

Beans, French or Kidney, may be sown as required during the month. In the coolest districts of the State it would not be advisable to do so very extensively, for early frosts would destroy the beans; but in the warm, moist coastal districts they may be sown as extensively as may be required.

Beet, red.—Sow a little seed, and endeavour to keep up a supply of this useful salad vegetable.

Beet, silver.—If any plants are needed for setting out, seed may be sown at any time during the month. This is a most useful vegetable, and a wholesome one, and it would be desirable to keep up a supply of new plants to replace those which may have become old and almost useless from constant cropping of the leaves.

Borecole or Kale.—This will succeed best in cool districts. Sow in a seed-bed and transplant when old enough, like cabbage. A very good variety is that known as the Dwarf Green Curled.

Broccoli.—Sow a little seed, and plant out in good soil, or soil made rich with manure, any seedlings which may be large and strong enough to plant out.

Brussels Sprouts.—This is a vegetable which should be grown in all the cool or fairly cool districts of the State, for it will succeed best in such places. Obtain the best seed procurable, and sow once or twice during the month. Before planting out in the garden, enrich the soil with a good quantity of manure. (The word manure in these directions is intended to apply to stable or farmyard manure, unless otherwise specified.) When the Brussels Sprouts seedlings are large enough, plant some out about two feet apart, and cultivate the ground between them until the "sprouts," or little cabbages, are ready for use.

Cabbage.—Sow a sufficient quantity of seed to keep up a supply of plants, and plant out well-grown seedlings according to requirements. As the cabbage is one of the chief vegetables used in New South Wales, and seems to be appreciated more than any other, a good supply of well-grown seedlings should always be available in order to keep up a succession, unless, of course, a change of vegetable is required.

Carrot.—A succession of this useful vegetable should be kept up as long as possible, and it is possible to do this in many parts of the State. The ground should be well and deeply dug, but it is not advisable to apply manure directly for the crop, especially rank and unrotted manure. The surface soil should be made as fine as possible for the seed. Sow in drills about 1 foot to 18 inches apart. Thin out the seedlings well, after they have attained the height of an inch or two, and keep down weeds. As the carrots are growing, cultivate them frequently.

Cauliflower.—There should be a good stock of young plants on hand by this time, ready for planting out. The cauliflower needs abundance of good manure, as well as good cultivation, during its growth, which should be continuous and without a check. Transplant the seedlings, or the pricked out plants, with as much care as possible, and to do this

well the soil about the young cauliflowers should be watered copiously before they are taken up. They can thus be lifted easily, and without breaking many of their roots.

Celery.—Sow sufficient seed to keep up a succession of plants for requirements. Prick out seedlings when they are large enough, and afterwards transplant to some heavily-manured soil. Advanced plants, well grown, may be earthed up, or boarded up, or treated in the most convenient manner to ensure the leaf stalks being thoroughly well blanched. Try the self-blanching varieties, for they are easier to manage than the green kinds.

Endive.—A little seed of this lettuce-like vegetable may be sown. Seedlings ready for the purpose may be planted out, but it would, perhaps, be best to sow in rows where the plants are to grow, and this will, to a great extent, prevent them running to seed, as transplanted endive is likely to do at this time of year. Grow them quickly, and, if necessary, use abundance of water and liquid manure.

Turnip.—Sow a little seed in drills from time to time during the month, taking care to thin out the seedlings well.

Potato.—Sow a few rows during the month in well-manured ground, and take the precaution to see that the ground is well drained. Obtain medium-sized whole potatoes, quite free from scab. Plant in rows about 3 feet or so apart, and drop the potatoes in the drills about 1 foot apart. The drills should be 4 or 5 inches deep. As soon as the potatoes appear, cultivate the ground well between the rows, and do not earth up the plants.

Peas.—In the cool parts of the State, try a few rows, if the weather is not too dry.

Radish.—Sow a few seeds from time to time during the month.

Mustard and Cress may also be sown to meet requirements.

Watercress.—Wherever possible this plant should be grown. It needs a great deal of watering, if grown in the garden.

Flowers.

Look ahead for any autumn planting that may be necessary, and in good time make all preparations, for the autumn is about the best season of year to plant out all kinds of evergreens, trees, shrubs, or small flowering plants, as well as a multitude of hardy annuals, before winter sets in. Spring planting sometimes results in disaster, and numbers of plants are lost through hot and dry weather setting in suddenly and very early.

Cuttings of many kinds of plants may also be struck easily during the autumn; the month of April and the latter part of March is about the very best time for rose-cuttings to root.

There is no hurry to plant just yet, but the thing is to be prepared for the planting, and this should be taken in hand during the month.

Dahlias in flower will need attention by the removal of all seed vessels, and pruning back the branches that have borne flowers. New shoots will soon appear, and these will grow quickly and then produce more flowers. If the weather be dry and the dahlias appear to be unsatisfactory water them well occasionally, and apply a little liquid manure. After the watering spread a thick mulch of manure around the plants.

FARM NOTES.

Clarence River District—February.

T. WALDEN HANMER.

Potatoes.—The autumn crop should be planted this month. Every care should be taken to see that the seed used is free from all disease. The spring planting in this district, taking it as a whole, was a very inferior crop, owing to the dry season ; although we heard of a few farmers getting good returns off low-lying land, which in a wet season would almost certainly have been a failure. Most of the potatoes were, however, very small. Bliss's Triumph, Circular Head, Early Rose, and Brownell's Beauty appear to be the most favoured varieties grown in this district. At the Grafton Experimental Farm we had very good results from Magnum Bonum, but this, being a white variety, seems to find less favour with growers. In addition to the above varieties we tried this season Beauty of Hebron, Aroostook County Prize, Satisfaction, Northern Star, Early Northern, Extra Early, Vermont, Cambridge Kidney, and Early Ash-leaf Kidney. They were planted on a volcanic ridge, and on account of the dry season naturally were not prolific or a satisfactory crop. Given an average Clarence River season, we are of the opinion that the results would have been good. The rains early in December and January, though very welcome, were not sufficient to add very materially to the water holes, but had a very beneficial effect on maize crops, and late maize crops should now be assuredly good.

Maize may be planted this month for green stuff for dairy stock.

February is a very good month to prepare land for autumn sowing of lucerne. Land for this crop cannot be brought to too fine a tilth, and requires deep ploughing and all weeds well eradicated. After being ploughed, if weeds show up again they should be ploughed out yet again. We think that too much cannot be said in favour of every farmer having a few acres of lucerne, but the land must be thoroughly and deeply worked if the best results are to be obtained, and seed should be sown at the rate of from 15 to 20 lb. per acre, harrowed in, and rolled down.

Other crops for green feed are buckwheat, wheat, barley, oats, rape, tares, and sorghum.

In the vegetable garden sow lettuce, cabbage, cauliflower, spinach, beet, turnips, French beans, and peas.

Farmers would do well to try a little of the new and increasingly popular grass called Rhodes Grass. This grass appears to do very well in this district, and about an ounce will sow an acre.

Glen Innes District.—February.

R. H. GENNYS.

This is a good month to sow the green fodder crops intended for winter use, such as rape, barley, wheat, oats, rye.

Rape.—The variety known as "Dwarf Essex" is one of the best to grow.

Barleys.—Cape and Skinless for green feed. The latter should be sown thickly, as it does not stool too well. It is very sweet, and much relished by stock.

Ryes may be sown for winter feed. These will stand eating off by cattle, and are a great stand-by, and do not require too rich a soil. "Emerald Rye" is one of the best.

Oats and *Wheat* may also be sown. The latter is sweeter than oats for milking cows; choose a variety that grows quickly, such as Cumberland, Zealand, Lambrigg White Lammas, &c.

Turnips may also be sown this month.

Land may also be turned over a first time for winter sowing.

CROWN LANDS OF NEW SOUTH WALES.

The following areas will be available for selection on and after the dates mentioned:—

For Conditional Purchase

Land District.	Name of Holding, &c.	Total Area.	Parish.	County.	Price per Acre.	Date available.
		a. r. p.			£ s. d.	1906.
*Bellinger ..	Resumed Area, No. 831.	100 0 0	Fenton	Fitzroy ..	2 0 0	15 Feb.
Braidwood .	....	524 0 0	Merigan .	Murray .	1 0 0	1 Mar.
Casino ..	....	213 1 0	Bungabbee	Rous .. .	1 0 0	1 ,,
*Casino	Resumed Area, No. 905.	160 0 0	Loadstone	,, .	2 0 0	15 ,,
*Casino	....	360 0 0	Etterick .. .	,, ..	1 5 0	15 Feb.
*†Mudgee .	Mudgee Population Area.	123 0 0	Mudgee	Wellington .	2 5 0	22 Mar.
*Picton .	....	40 0 0	Cumbertine	Camden ..	0 10 0	15 Feb.
*†Port Macquarie	....	286 0 0	Kindee and Albert	Macquarie	1 10 0	15 Mar.
Rylstone .	....	240 0 0	Goongal	Roxburgh .	1 0 0	1 ,,
*Singleton	....	54 3 0 and 72 0 0	Darlington .	Durham	1 15 0 and 2 0 0	22 ,,
Tamworth	....	500 0 0	Roymn .. .	Parry .	1 0 0	1 ,,
Tenterfield ..	Koreelah	260 0 0	Gore .	Buller ..	1 0 0	1 ,,
Warialda	.. ... .	186 1 0	Yetman .	Arrawatta	1 0 0	15 ..

* For original applications only. † Also set apart as special area.

Special Area.

Port Macquarie Land District, in parishes Albert and Kindee, county Macquarie, 286 acres; maximum area, 100 acres; minimum area, 40 acres; price, £1 10s per acre. Available for original applications only on 15th March, 1906.

Mudgee Land District, within the Mudgee Population Area, 123 acres; maximum and minimum areas, 123 acres; price, £2 5s. per acre. Available for original applications only on 22nd March, 1906.

For Settlement Lease.

S.L. No.	Name of Land District.	Holding, &c.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
			acres.		acres.		£ s. d.	1906.
*825	Nyngan ..	....	40,790	4	10,130 to 10,240	Girilambone, 4 to 14 miles.	21 2 1 to 21 6 8	22 Feb.

* Original applications only.

AGRICULTURAL SOCIETIES' SHOWS.

1906.

Society.	Secretary.	Date.
Alstonville Agricultural Society	J. C. Foster	Feb. 7, 8
Central Cumberland A. and H. Association, Dural	H. A. Best	„ 7, 8
Moruya A. and P. Society	John Jeffery	„ 7, 8
Wollongong A., H., and I. Association (Wollongong)	J. A. Beatson	„ 8, 9, 10
Guyra P., A., and H. Association	H. W. Vincent	„ 21, 22
Lithgow A., H., and Produce Society	H. N. Jolliffe	„ 21, 22
Ulladulla Agricultural Association	C. A. Buchan	„ 21, 22
Liverpool A., H., and A. Society	P. A. Shepherd	„ 28, Mar. 1
Lismore A. and I. Society	T. M. Hewitt	„ 28, „ 1
Gunning P., A., and H. Society	Ernest E. Morgan	Mar. 1, 2
Robertson A. and H. Society	R. G. Ferguson	„ 1, 2
Campbelltown A., H., and I. Society	A. R. Payten	„ 6, 7
Tenterfield Intercolonial P., A., and Mining Association	F. W. Hoskin	„ 6, 7, 8
Bega A., P., and H. Society	John Underhill	„ 7, 8
Walcha P. and A. Association	S. Hargrave	„ 7, 8
Canowindra P., A., and H. Association	John J. Finn	„ 7, 8
Macleay A., H., and I. Association	E. Weeks	„ 7, 8, 9
Fair days	....	„ 9, 10
Narrabri P., A., and H. Association	J. McCutcheon	„ 7, 8, 9
Nepean District A., H., and I. Society, Penrith	E. K. Waldron	„ 8, 9
Berrima A., H., and I. Association (Moss Vale)	James Yeo	„ 8, 9, 10
Bombala Exhibition Society	W. G. Tweedie	„ 13, 14
Cumnock I., A., and H. Association	W. L. Ross	„ 14
The P. and A. Association of Central New England, Glen Innes	Geo. A. Priest	„ 13, 14, 15
Clarence P. and A. Society, Grafton	T. T. Bawden	„ 14, 15
Camden A., H., and I. Association	A. Thompson	„ 14, 15, 16
Oberon A., H., and P. Association	W. Minehan	„ 15, 16
Newcastle and District A., H., and I. Association	Owen Gilbert	„ 15, 16, 17
Goulburn A., P., and H. Society	J. J. Roberts	„ 15, 16, 17
Lower Clarence Agricultural Society, Maclean	George Davis	„ 20, 21
Cobargo A., P., and H. Society	T. Kennedy	„ 21, 22
Gundagai P. and A. Society	A. Elworthy	„ 21, 22
Blayney A. and P. Association	H. R. Woolley	„ 21, 22
Manning River A. and H. Association	S. Whitehead	„ 22, 23
Crookwell A., P., and H. Association	C. T. Clifton	„ 22, 23
Tamworth Agricultural Association	J. R. Wood	„ 27, 28, 29
Molong P. and A. Association	C. J. V. Leathem	„ 28
Durham A. and H. Association, Dungog	C. E. Grant	„ 28, 29
Mudgee Agricultural Society	J. M. Cox	„ 28, 29, 3
Cooma P. and A. Association	C. J. Walmsley	April 4, 5
Bathurst A., H., and P. Association	W. G. Thompson	„ 4, 5, 6
Warialda P. and H. Association	W. B. Geddes	„ 4, 5, 6
Richmond River A., H., and P. Association (Casino)	E. J. Robinson	„ 5, 6
Royal Agricultural Society of New South Wales	H. M. Somer	„ 11 to 19
Hunter River A. and H. Association (West Maitland)	C. J. H. King	„ 24, 25, 26, 27, 28
Orange A. and P. Association	W. Tanner	„ 25, 26, 27
Wellington P., A., and H. Society	A. E. Rotton	May 1, 2, 3
Upper Manning A. and H. Association	Edw. Rye	„ 3, 4
Moree P. and A. Society	S. L. Cohen	„ 8, 9, 10
National A. and I. Association of Queensland	....	Aug. 7, 8, 9, 10, 11
Murrumbidgee P. and A.	A. F. D. White	„ 22, 23
Junee P., A., and I. Association	T. C. Humphrys	Sept. 5, 6
Young P. and A. Association	Geo. S. Whiteman	„ 12, 13
Temora P., A., H., and I.	W. H. Tubman	„ 25, 26
Yass P. and A. Society	W. Thomson	„ 26, 27

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Agricultural Gazette of New South Wales.

Tomatoes and their Diseases.

WALTER W. FROGGATT, F.L.S.,
Government Entomologist.

THE increasing growth in public favour of the tomato, both as a fruit and for culinary purposes, is unprecedented in the history or development of any other cultivated plant. Less than forty years ago the general public had hardly heard of the tomato, which was only a garden curiosity in most places, growing a small red berry, known as the "Love Apple." At the present time it has been developed into a large fleshy fruit, of which there are hundreds of well-defined varieties. No kitchen garden is complete without it, and thousands of acres are devoted to its cultivation in Australia, and an immense quantity of it is used, both in the fresh state and for sauce making, and a great quantity of capital is invested in the industry.

The tomato belongs to the well-known family *Solanaciæ*, to which we are beholden for many valuable commodities, such as the tobacco plant, potato, Cape gooseberry, capsicums, and other useful species, while, on the other hand, there are many wild solaniums, such as the deadly nightshade, just as dangerous; in fact until cultivated, the tomato was said to have poisonous properties. The tomato is scientifically known under the name of *Solanium lycopersicum*, and is supposed to be originally a native of Peru, but is also found in a wild state in Brazil, Mexico, and the western States of North America. It is one of those plants that is easily distributed through the agency of birds, and in many parts of North Queensland, far from the haunts of men, tomatoes may be found clustering along the river banks, seeds having been carried from the distant station homesteads by wandering birds.

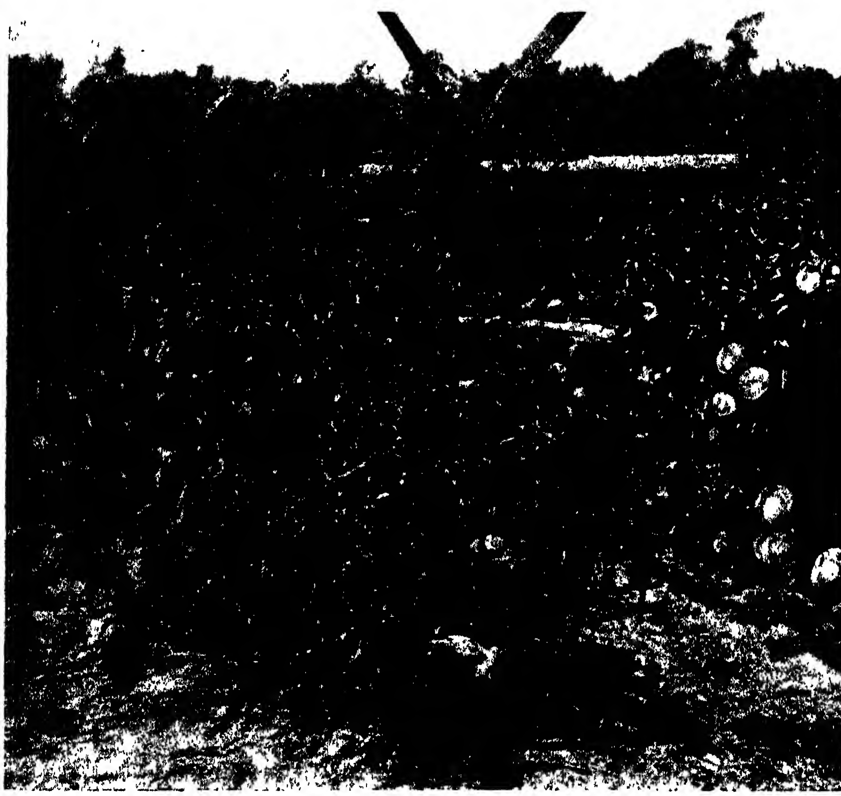
The cultivation of the tomato in England only dates back to the end of the eighteenth century, and one of the first records, where the weight of fruit grown upon certain plants, is given in the pages of the Transactions of the Horticultural Association, 1818.

The tomato being a semi-tropical fruit, the thick luxuriant foliage is very susceptible to frost; yet with care it can be grown in comparatively cold climates, and large quantities are imported annually from France for the English market. Several large establishments in the Channel Islands grow them under glass, while they are extensively grown in the same manner in England. In America the tomato is greatly cultivated, and "canned tomatoes" are well and favourably known all over the States.

As a tomato-growing country Australia has many advantages over all these countries, as here we can, in an ordinary season in suitable soil, grow them right through the summer without any protection from frost or heat, though there are times when the two extremes do considerable damage.

A

The high state of cultivation of these plants, and the hundreds of different varieties that have been produced by the gardener, is probably one of the reasons that the tomatoes of the present day are subject to so many obscure diseases, besides being attacked by fungus diseases and insect pests. As the writer has always taken a keen interest in the industry, studied the insect pests, and observed the outward effects of the more typical fungus diseases, he proposes to give an account of the troubles to the tomato-growers. The greatest difficulty that our gardeners have to contend with are the late frosts, and growers often sustain very heavy losses when an exceptionally



Tomatoes on Trellis.

late frost occurs. It is the usual custom to plant out the main crop in one batch, and thus the field is too large to protect in detail, so that the whole lot is often cut down in a single night. If, however, a few hundred plants were set out in advance, and each one protected at night with brush, bark, or bagging, until the frost danger had passed, these plants would often bring in a much greater return per plant than double their number later on, for it is the early tomato that brings the price.

It is usual to plant the tomatoes in seed-beds, but some of the Chinese gardeners collect all the empty tins, and after burning them in the fire until the solder is melted and the ends drop out, so that the simple curled tin remains, pack these in boxes like flower-pots, filling each with cow manure

Tomatoes on Stakes.

and sand. Three or four seeds are placed in each, and after they shoot the best grown seedling is kept and the others pinched out The advantage of this method of propagation is that they can let these plants flower under shelter and become quite big plants, and as soon as the frost danger is past

plant them out with the roots held together with the tin, which at the same time is so loose that it does not interfere with the spread of the roots, and the plant is not checked in the act of transplanting.

At present, all our early tomatoes first in the Sydney markets come from Queensland, and though the quality is often very poor, as they are gathered before they are properly ripened, yet they bring a good price.

Glass is so cheap, and tomatoes so prolific, that in a suitable locality close to Sydney it should pay to grow them under glass for the early market. When one has seen the careful manner in which tomatoes are grown under glass in England, every stray lateral pinched off and each fruit looked after like a pet child, he wonders if this could not be profitably followed here.

The average tomato-grower will tell you that it will not pay to stake or trellis tomato plants, and they are simply planted out in rows, the plants sprawling out on all sides, half the fruit resting on the damp ground, within the influence of all fungus diseases or insect caterpillars that live chiefly in the soil; or else they are exposed to the full rays of the hot sun, and an extra hot snap sometimes scalds thousands of fine tomatoes in a few hours.

No plant repays good cultivation more than the tomato, and half an acre staked or trellised would often yield, I am sure, as much as two acres as ordinarily planted. In trellising tomatoes the triangle trellis sloping up on each side like the ridge of the roof of a house seems to suit several kinds, and while the air and light circulates all round them, the sun will not scald them as it is liable to do on a perpendicular structure.

During the past season (1904-5) when working at the insect pests of field crops, I took the opportunity of making some experiments as to the value of treating the tomato seed with fungicides before planting it, and the damage, if any, to the germinating qualities of the seed by soaking in very strong solutions.

The seed of four varieties was divided up into four lots; three treated, first with formalin, second with bluestone, third with hot water, and the fourth untreated. They were sown in rows in shallow seed-boxes, and afterwards planted out in the ordinary way, but the season was a remarkably good one, and though these experiments were carried out at Minto and Gosford, the actual results were nil, all the treated and untreated seedlings made an equal growth, and the fruit was of an average clean quality right through. The vitality of tomato seed is said to be very great, and it has been stated that seed kept twenty-five years had grown good plants. Though no results were observable, considering the number of obscure diseases that these plants are subject to, it would probably pay every grower to take the precaution of treating his seed before he planted it.

Cut Worms.

While there are probably half a dozen or more different species of lepidopterous larvæ that feed upon the foliage, flowers, and fruit of the tomato, the bulk of the damage can be truly placed to the credit of the dull-green grub of the American boll-worm (*Heliothis armiger*), which, world-wide in its

distribution, and very variable both in the grub and moth stage in colouration and markings, is known as a pea-grub, a cotton-boll pest, a maize moth, and cut-worm generally.

Though cut-worms often come out of the ground and nip off the gardener's young plants just after they have been set out, still, in the case of the tomato, the most damage is done to the green and half-ripened fruit, the grubs cutting their way in to devour the seeds, and thus causing the fruit to rot and decay. It can, therefore, be easily understood that if the plants are sprawling all over the ground and the fruits resting close to or on the damp soil, they are much more at the mercy of cut-worms than those staked or trellised.

Cut-worms are not difficult to trap with heaps of half-dead weeds placed among the plants, for they crawl under them for shelter instead of burrowing into the ground, and in these simple shelters can be easily collected and destroyed, while an ounce of Paris green well mixed with a pound of damp pollard and placed in little hollows in the ground among the growing plants forms a very attractive food for all these caterpillars, which eat it readily and die.

Rutherglen Bug (*Nysius vinitor*).

Is chiefly a foliage-infesting plant, as far as tomatoes are concerned, but if they come into a field in numbers and cover the under-surface of the leaves, among which they hide, they soon cause it to wilt and die. Spraying is of little use, for they fly at the least alarm on a hot day, if on the outside of the leaves, and if beneath are not damaged. When the plants are grown so that one can get down between the rows, an old broom for a beater, and a large shallow dish containing water and kerosene, or even a sheet dipped in the same mixture and placed beside the plants will capture an immense lot, and with a little care and trouble in sweeping the tops down destroy the bulk and hunt the rest away. I have found the best time to shake or beat out Rutherglen bug is between daylight and 8 o'clock in the morning.

Rosette of the Tomato.

This name was applied by Cobb (*Agricultural Gazette, N.S.W.*, 1902) to a disease which often attacks tomatoes after they are well-grown plants, aborting all their fresh foliage into tiny aborted leaves and form irregular masses or clusters, often becoming a dense mass of fuzzy foliage. Though some more or less well-formed fruit may grow on the lower branches before the plant develops this perverted growth, those afterwards formed among the new distorted foliage and swollen stems never grow to any size. This curious disease was very widely spread over the State a few years ago, equally bad in plants grown from imported or local seed. There were a considerable number on the irrigation plots at our Bathurst Experimental Farm, but when they were pulled up and burnt no more showed up, so that it appears to be local and not liable to affect adjacent plants. Cobb's drawing shows the clusters of leaves at the extremities of the branchlets to form well-defined rosettes, but, I think, in the commonest form the rosettes were

much less pronounced, and the whole of the upper portion of the plant clothed with aborted foliage.

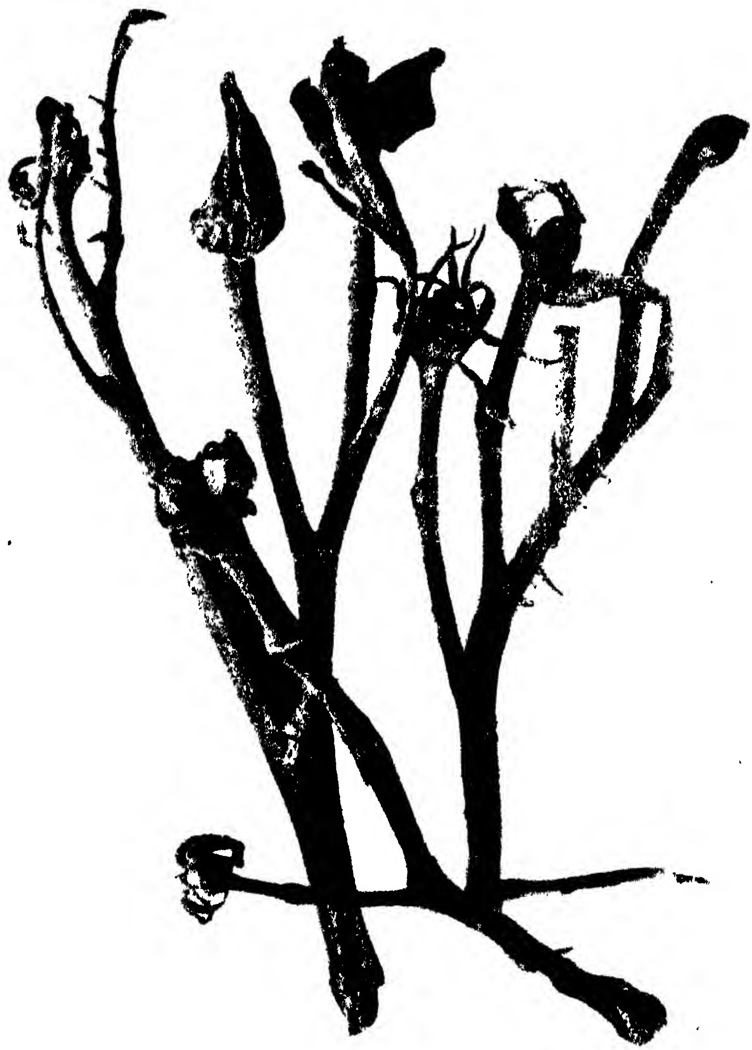
Branch of Tomato showing Tomato Rosette, one-half size.

A, terminal rosette, consisting of minute leaves and abortive fruits; B, abortive fruit panicle; C, fruit that would contain seed of a questionable nature; D, adventitious rootlets; E,E, overgrown condition of the branches; F,F, dead and dried-up leaves of the normal form, which were produced earlier in the season. This feature, and the apparent absence of plant parasites, may point to irritation, due to the attacks of some ye undetected animal parasite.

There is no known remedy, but it would be advisable to pull up and destroy all plants affected in this manner as soon as the disease is noticed.

Sheath-calyx in Tomato.

I propose this name for a curious malformation of the young fruits of tomato plants, in which, instead of the fruit growing, the calyx is produced into a pod-shaped sheath, which might be likened to an attenuated



Sheath-Calyx in Tomato.

form of the covering of the well-known Cape gooseberry. The plants, like those infested by Rosette, at first grow into well-developed healthy plants, and the first symptom is a slight upward curl of the leaves, so that they show part of the under-surface, the terminal flower-stalks become abnormally

thickened, and when the flower drops off the fruit stops growing, while the calyx goes on until it is often several inches long, coming to a regular lance-shaped tip. Later on, the closed sheath is not so pronounced, and rugged and broken away, shows a small warty rugose fruit at the base. This disease also slightly aborts the leaves, and may be closely allied to Rosette, but the structure of the fruits and calyx are most characteristic points.

It has been noticed for some time in the Gosford district, where large quantities of tomatoes are grown; and by some growers these affected plants are said to be increasing in number during the last few years.

Is it possible that this is a case of cross fertilization by insects? That the pollen from Cape gooseberry flowers is carried into the tomato flowers, thus aborting the young fruits and producing the unexpanded calyx. The Cape gooseberry is quite a common weed in our scrub and gardens, and the pollen could be easily obtained for experiment.

Sleeping disease of Tomato. *Fusarium lycopersici*, Sacc.

This disease first appeared in Guernsey, but soon afterwards was reported from several places in Great Britain, and a few years ago specimens of tomato plants forwarded by me to Mr. Grant, at the Botanic Gardens, were found by him to be affected with this curious disease.

This disease takes its popular name from the sudden manner in which an apparently well-grown healthy tomato plant will suddenly wilt, droop down, and die almost in a night. This is caused by a fungus that gains an entrance into the smaller roots, rapidly extending through the main roots into the base of the stem, and at once affects the whole of the plant. The outward symptoms are a discolouration of the stem when cut through, instead of the natural normal green tint, and a close examination shows that the stem above the ground is more or less clothed with fine white mould, spores of fungus.

There is no known remedy for this fungus, no fungicide has been found to check it, and the only recommendations that have been made by investigators is, to pull up all plants, weeds, and dead leaves, rake them together and burn; and mix quicklime with the soil they have been growing in. Seeds taken from diseased plants, or from plants grown in an infested district, are said to transmit the disease, and should not be used.

Black Rot. *Macrosporium tomato*, Cook.

This is another well-known trouble to tomato growers in Australia. The plants grow well, and produce well-formed fruit, which when about half-grown develop a brown blotch on the blossom end; this increases with the growth of the fruit, until the upper half of the tomato is sunken, black, and destroyed.

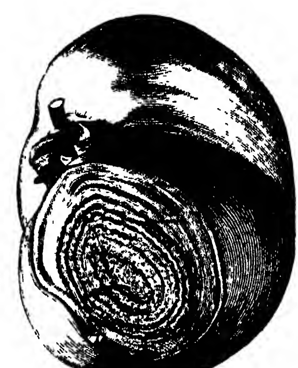
It has been studied and the structure of the fungus worked out in other countries, where it is quite as common as it is here, and several conclusions

have been arrived at; first, that several species of tomatoes are much more subject to it than others; secondly, that ground heavily manured with fresh stable manure will often cause a great increase in the disease, or produce conditions of growth favourable to its development; and excessive watering is also said to contribute to its spread. Whenever a fruit shows the tell-tale brown spot, pull off and burn, and if the subsequent tomatoes are affected, the best thing to do is to pull up the plant and destroy it before the fungus matures and spreads.

Spray with Bordeaux mixture early in the season to check it. Galloway recommends (Annual Report, Department of Agriculture, U.S. America, 1888):—"Burn all diseased plants, and spray with potassium sulphide (liver of sulphur)." The formula given in an American journal, and recommended as a spray for all young tomatoes when planted out, is as follows:—Dissolve 1 oz. potassium sulphide in a gallon of hot water, and then make up to 2½ gallons with cold water.

Pimply Rot.

This disease, though forming black blotches upon the half-grown fruit, can be easily distinguished from Black Rot, as it commences on any part of the fruit, and the infested area is generally more or less circular in form, and remains smooth and glossy for some time after the infestation, later on showing very distinctly concentric rings round the small central portion, like the cross section of a tree trunk, the whole forming a sunken flattened patch, sometimes occupying the greater part of one side of the fruit. Cobb figured and described this disease (*Agricultural Gazette*, N.S.W., 1895).



A Tomato attacked by Pimply Rot.

The disease appears on a flattened circular area in the form of concentric rings.

Spraying seems to be of no use in checking this disease, which is not as common in this State as it was some years ago. All diseased fruits and plants should be burnt.

Leaf Rust of Tomato. *Cladiosporium fulvum*, Cook.

This is a well-known disease in Europe and the United States, and is worst when plants are grown under glass; but as hardly any are grown under these conditions here, it is not, as far as I know, a serious pest in Australia. It first appears as small brown spots upon the young foliage, which gradually increase in size until the whole of the leaf is discoloured, and the under surface covered with rusty-brown spots. When this stage is reached the foliage shrivels up and falls off.

Spraying with dilute Bordeaux mixture should be commenced as soon as the first spots appear, and repeated at intervals. If taken in time, the spread of this rust can be checked.

Cross-section through a sorus of Septoria lycopersicæ found on leaf of the Tomato.

a, Surface of the tomato leaf; *b*, fungus tissue; *c*, spor-producing layer; *d*, spores escaping through the mouth of the sorus.

Cobb (*Agricultural Gazette*, N.S.W., 1902) describes a tomato leaf blight under the general name *Septoria*, which appears to be allied to, or cause a very similar destruction of the foliage on the lower branches of the plants. It produces flat, roundish, dark grey, minute spots on the leaves. "Vines attacked by this disease may be killed outright, or may linger on in a more or less defoliated condition. The disease is often so bad as to defoliate the vines for a distance of 3 feet from the root." The same treatment as that applied to the Leaf Rust will check this allied disease.

Using up Bones for Manure.

On several occasions, in answer to inquiries, advice has been published in this *Gazette* concerning the best way of utilising the quantities of bones that accumulate about the place, and generally go to waste.

In the *Farmers and Fruit-growers' Guide* (4th edition), page 51, Mr. Guthrie explains how to convert small quantities of bones into superphosphate, and that is probably the best and most economical way of treating them; but to carry out the process involves some little difficulty, especially to persons unaccustomed to handle stuff like sulphuric acid. An easy method of treating them is to make a sort of compost heap, putting a layer of 6 inches of bones, then a layer of 3 inches deep of quicklime, and on top of that spread loam to the depth of 4 inches. Repeat the layers until the heap is complete, and then cover it all over with a good thick layer of fine soil. Holes should then be made right down through the heap, and water poured in to slack the lime. The mass will become hot, and at the end of about three months the heap will slice down like cheese, and the material, in the shape of a substantial fertiliser, can be applied to the land, where a great variety of crops will readily assimilate it.

Grain Elevators.

N. A. COBB.

(*Agricultural Gazette*, February, 1901.)

I.

WHEN I see a farmer go to his nearest market town, several miles distant, pay 5d. each for bags by the waggon load, take them home, and put them away in a dry place until wanted, then once more carry them out to the field, fill them with grain, sew them up, and, if he is a careful man, label each bag separately, lift the bags of wheat on to a high dray, take them to his barns, unload them, stack them, and then later on lift them down again, rip them open, clean the grain by machinery, bag it up again, label the bags again, and stack them once more until such time as the market price suits him; when I see him, having made a sale, unstacking them once more several weeks later, sewing up the holes the mice have gnawed meanwhile, lifting them again on to his high dray, and off again, one by one, at the railway shed; when I see the grain leaking out through bursted, torn, and gnawed bags all the way from the railway-shed to the seaboard, when I see bags of precious grain, representing the income of farmers in all parts of the country, standing days at a time exposed to the wet weather and losing value—simply because grain in bags cannot be handled fast enough to prevent a glut at the metropolitan or other central market; when I see valuable property, such as railway trucks, standing idle day by day, letting interest on the people's money go to waste, because these trucks cannot be loaded with bags of wheat quickly, and despatched to their destination; when I see thousands of bushels of uncovered bags of wheat caught in a shower; when I see the wheat, after several hundred miles' railway journey, unbagged and put into fresh bags before transhipping, because the original bags are worn out; when I see them again lifted, and lifted, and lifted slowly into the ship's hold; finally, when I lean back with a shudder and try to imagine the high old time the ship's rats and the weevils have among this honeycomb of bags of wheat—a picnic lasting, it may be, several months—until the grain is at last unloaded in London and shot into an elevator—when I see all these things I cannot find words powerful enough to stigmatise this universal use of bags. Because this thing is wrong in principle, and can be remedied.

The secret of the remedy—no, it's no secret; it is fairly written against the sky in scores of the greatest and most prosperous towns in America and Europe. Not the secret, then, but the principle of the remedy is this: *threshed grain can, in a large measure, be handled like water.* It will run, it can be poured, it can be pumped; and if only our farmers, merchants, and

railway architects will take pains to consider this simple idea, the result will be a change in our methods of handling grain, beginning in the field and ending at the mill.

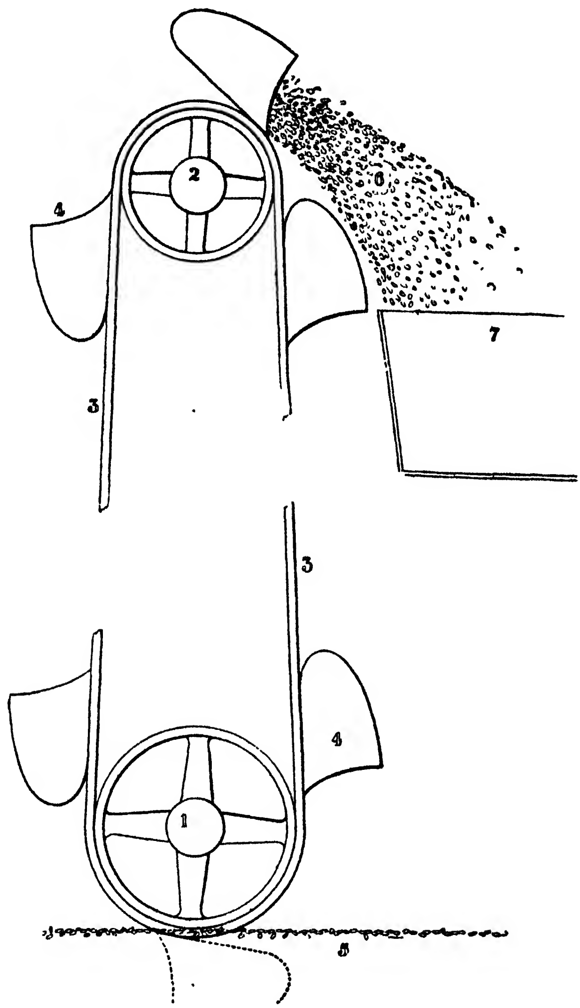


Fig. 1.—Rough Diagram to Illustrate the Action of an Elevating Belt.

The pulleys 1 and 2 carry an endless band, 3, to which are riveted buckets, 4. As the buckets pass round the lower pulley they dip into the grain, 5, and fill themselves. As they pass over the upper pulley they shoot the grain into a trough, 7. The distance from the lower pulley to the upper is over 100 feet in the largest elevators.

What would you think of a man who lifted all the water out of his well in a bucket instead of with a pump? What would you think of a man who lifted all the water out over the edge of a tank instead of letting it run out through the faucet at the bottom? What would you think of a man who habitually carried water down-hill instead of letting it run through a spout?

What would you think of a man who, having 400 gallons of water to transport, put it into 400 1-gallon receptacles instead of into one 400-gallon tank? What would you think of a man who caught his roof-water in an underground tank, so as to have the pleasure of pumping it up again when he wanted it for use? What would you think of a man who preferred to store his water in a way that not only allowed, but actually invited various sorts of vermin to injure it, and cause it to leak away? The English language is hardly strong enough to tell how big a fool such a man would be.

Yet, observe how grain is handled in Australia. It is lifted by hand, when to lift it by simple and inexpensive machinery would be both easier and cheaper. It is lifted over the edges of receptacles instead of being allowed to run out of them at the bottom; it is habitually carried down-hill instead of being allowed to run of its own accord. When being transported by the thousand bushels, is cooped up in 4-bushel receptacles. It is everywhere put down so as to be lifted again by hand at the next handling. It is preferred to store it in a way that not only allows, but actually invites various vermin to injure it and cause it to leak away.

Why not introduce the elevator system of handling grain as has been done in America and Europe?

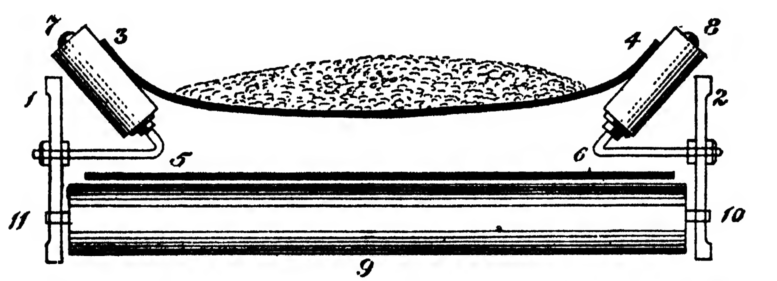


Fig. 2. Cross-section of a horizontal grain-belt taken near one of the pairs of oblique rollers used to keep the edges of the belt somewhat raised.

1 and 2, sides of the long framework.
3, 4, edges of the belt.
5, 6, returning portion of belt.
7, 8, oblique rollers for turning up the edge of the belt.
9, roller for support of 5, 6
10, 11, bearings of the rollers 9.

The grain elevator, as its name indicates, is a contrivance for raising grain from a given position, generally near the ground, to a higher position, generally a bin or silo, from which it can at any moment be delivered conveniently and quickly by means of proper machinery.

The essential elements of the grain elevator are:—

1. The elevating and transferring machine.
2. The weighing machine.
3. The bins or silos.
4. The cleaning machine.

The elevating machine is built in a great variety of forms, all, however, embodying the same principle, if we overlook the pneumatic elevator, which we may do for the present.

An endless band passes round two pulleys, one of which is placed above the other, and this endless band carries buckets which, on passing round the lower pulley, dip into grain contained in a hopper, and, on passing round the upper pulley, shoot the grain that has been dipped up into a receiving hopper or spout. See Diagram in Fig. 1.

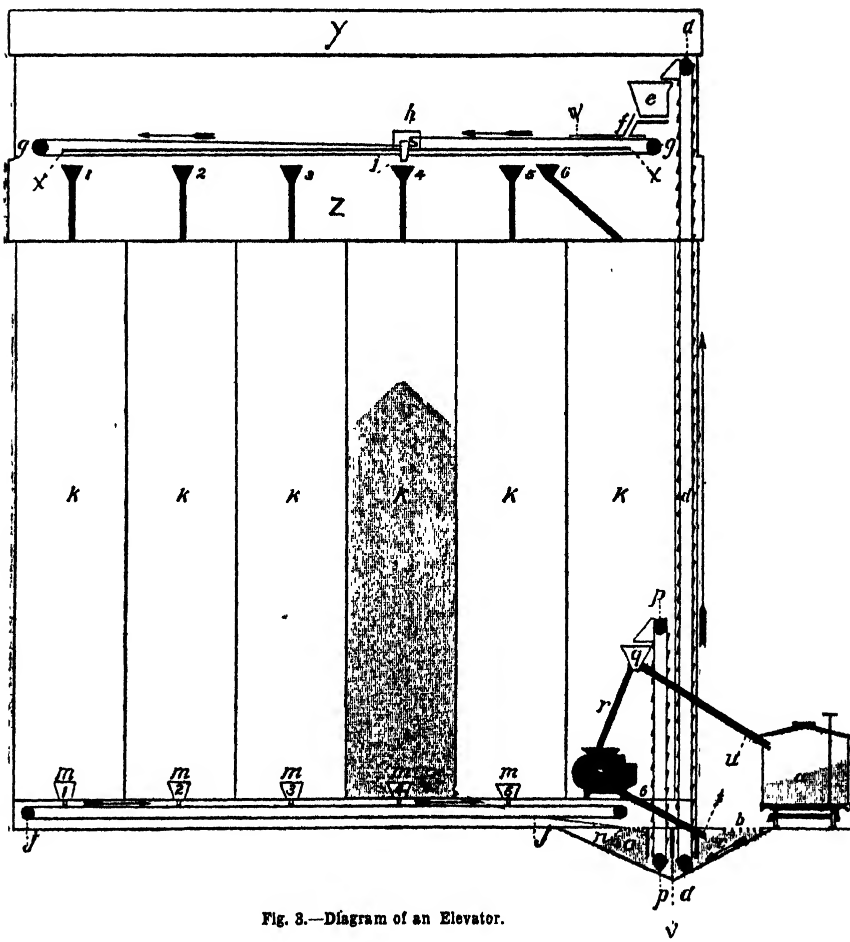


Fig. 3.—Diagram of an Elevator.

a, car with grain; *b*, grating over the hopper, *c*; *c*, hopper; *d d*, pulleys carrying the endless band and elevator buckets; *e*, weighing-bin; *f*, *w*, delivery spout to grain belt; *g g*, grain belt; *h*, zig-zag, which is movable back and forth on the track, *x x*; *i*, spout; *k k k*, bins or silos, to which the spouts, 1, 2, 3, 4, 5, 6, deliver grain; *m m m*, mouths of the bins or silos; *l l*, carrying-belt delivering into the hopper, *o*, through the grating, *n*; *p p*, secondary elevator delivering to hopper, *q*, whence the grain may go to the cleaner, *s*, *via r*, or to the car, *via u*; *y*, *z*, location of the roofs of the elevator.

The grain thus elevated may be weighed in special machines adapted to receiving spouted grain, and which automatically register the weights. These machines are usually located at the top of the elevator building.

Before or after weighing, usually after, the grain is carried to its destined bin or silo by means of horizontal belts, or inclined spouts, or a combination of both. The belts are made of canvas, leather, rubber, or a composition, and vary in width from 1 foot to 3 feet, and while usually running horizontally, may have a grade of 1 in 10, and yet work satisfactorily. A spout conducts

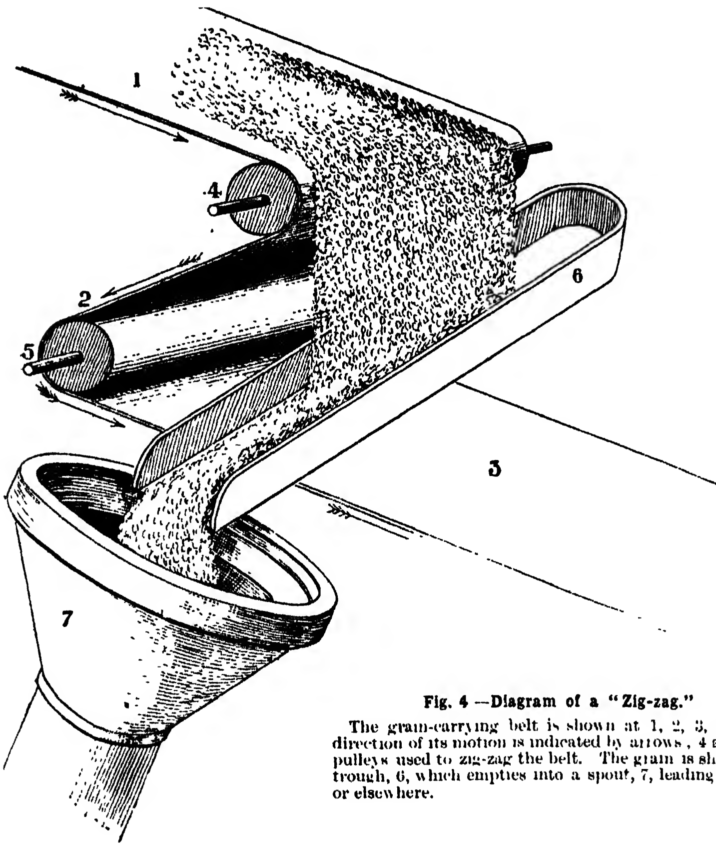


Fig. 4 —Diagram of a "Zig-zag."

The grain-carrying belt is shown at 1, 2, 3, and the direction of its motion is indicated by arrows, 4 and 5 are pulleys used to zig-zag the belt. The grain is shot into a trough, 6, which empties into a spout, 7, leading to a bin or elsewhere.

the grain on to the middle of the moving belt, which latter receives an upward curvature at its edges through the use of pairs of oblique rollers every 15 to 30 feet, according to its width. Such belts are shown in illustrations 3 and 5, and a diagrammatic cross-section is given in Fig. 2.

The grain-belt delivers its grain into hoppers or spouts, either at its turning point, or at an intermediate point by means of a special carriage which zig-zags the belt as shown in Fig. 4.

The terminal elevators now in process of construction in the United States are costing about 30 cents. per bushel of capacity. Previous to the recent advance in price of all kinds of material, terminal elevators were built at from 20 cents. to 25 cents. per bushel. I have seen (and examined in many cases) many hundreds of elevators in all parts of the United States, and among them all have seen but one with iron bins. They must be uncommon. The large

terminal elevators are seldom completed in less than twelve months; the smaller ones (100,000 to 200,000 bushels) may be contracted for at half the above time limit. As to particulars of most modern machinery, very much may be said. In general the grain-cars are run into the elevator and unloaded by means of steam-shovels—which are large scoops worked by means of rope tackle and a steam-winch, the scoops being dragged empty to the ends of the car by hand, and then hauled back by steam, thus bringing the grain out in the course of a few minutes. The grain falls through an iron grating of about 4-inch mesh, designed to catch coarse materials, and to prevent accident, and then goes down into the hopper, into which the elevator buckets dip (see Fig. 3). The buckets, of which there are a variety of good makes, hold about half a bushel, and are attached to an endless band, which passes to the top of the elevator; here the buckets, turning to begin their downward trip, empty themselves into the weighing-bins. These are so constructed as to be under the control of one man, who does the weighing. The book-keeper has his office near the weigher, and works in conjunction with him. An automatic signal warns the weigher when the weighing-bin is nearly full, and he, by moving a lever, starts the grain running into a second duplicate weighing-machine, during the filling of which he weighs and records the first, and starts it emptying itself into its assigned elevator bin. When the duplicate weighing-machine is full, the first is empty; and so these weighing-machines work along alternately. In the largest elevators a more elaborate system of the same nature is used. The weighing-machines are made by the principal scale-makers. The weighing-bins and other machinery in the top of a wooden elevator are supported on a different structure (separate) from the bins. The sides of these latter, in large elevators, vary in height several feet, according to their state of dryness, and are not a fit basis for the support of shafting &c. This great expansion and contraction of the walls of the bins is a peculiarity of wooden elevators; brick and steel bins are more stable.

The grain is spouted from the weighing-machines to any desired bin by means of belts and various ingenious spouts, the best spout I have seen being the design of E. D. Mayo, of Minneapolis. This is an elbowed revolving iron spout, with a high degree of adjustability. A circular steel track, 12 feet in diameter, is hung from the ceiling under the weighing-bin, concentrically with the mouth of the bin. A light and simple steel carriage running on this circular track supports the lower end of the iron spout, which runs out at an angle of 45 degrees from the mouth of the weighing-bin. This spout, therefore, revolves in a circle, and can be pointed in any direction; and attached to its lower end is a second long iron spout, with adjustable joints. The lower end of this latter rests on the floor containing the trapdoors leading to the various bins, and this lower end being on castors, the spout can be easily dragged by hand and placed over any trapdoor within a radius of 15 or 20 feet.

The grain is generally cleaned and graded on one of the lower floors of the elevator by means of machines having a capacity of 1,000 to 2,000 bushels per hour, prominent among which I may mention the "Monitor" Wheat-

cleaner, made at Silver Creek, N.Y. Wherever, in a large elevator, the grain is carried in a horizontal direction it is emptied on to a belt—flat, and about 3 feet wide—which runs horizontally, and is animated by means of pulleys run by an endless cable. This cable system runs in all directions throughout the elevator, and sometimes for a good fraction of a mile outside. Wherever it goes its main object is to animate a series of wide grain-carrying, horizontal belts. Sometimes, by means of an elevated outdoor system of this kind, grain is carried several hundred yards over the tops of buildings and warehouses to the ships' docks.

Whenever it becomes necessary to transfer the grain from a belt to a spout (as at a ship's side), a device is introduced by means of which the belt is zig-zagged and the grain is caught in a hopper, and so spouted. Figure 4 is a diagram showing the nature of one of these zig-zags. The zig-zags are a permanent feature of all large belts from which grain is spouted; and the best of them are on ways, and adjustable along the belt by means of hand-cranks.

The bins of wooden elevators are made of timber, 2 in. x. 4 in. to 2 in. x 8 in., spiked flatwise. The large terminal elevators, having bins often upwards of 75 feet deep, require 8-inch timber for the lower parts of the bins where the thrust is greatest; and this, among other reasons, adds to the relative cost of such elevators when compared with those of smaller size. The number of bins per elevator varies widely, according to the class of business, sometimes reaching two or three hundred. Large elevators often have bins of 50,000 bushels capacity and upwards. These hold grain of various grades, various kinds, various seasons, various owners, &c., &c.

These are, in general terms, the features of the most recently-built terminal elevators in the United States. The exterior appearance of some of these elevators is very well shown in the photographs (*not reproduced*) which I have taken as opportunity offered in my various visits to the great wheat handling centres of the world. Of such elevators there are some two hundred in the United States, located principally at Chicago, Minneapolis, Duluth, and Buffalo. A one-million bushel elevator requires engines giving 125 to 200 horse-power, according to circumstances.

The country elevators, such as are used in the principal wheat areas of the United States, have a capacity of 20,000 to 40.000 bushels, and are constructed at from 15 cents to 20 cents per bushel, according to size—20 cents for the smaller size and 15 cents for the larger size. These are now often fitted with gasoline motors instead of steam. These elevators, as a rule, do not admit cars. Those of older construction do not even admit teams. An outside platform (often roofed over) receives the grain-waggon upon a platform scales, and the load and the waggon are weighed. Without moving, a slide in the side of the waggon is pulled, and the grain runs from the waggon into the receiving hopper. When the waggon is empty it is weighed, and this weight subtracted from the first weighing equals the delivery. In the more newly-constructed country elevators provision is made for driving grain-t ams through the elevator. The illustration (Fig. 5) shows admirably the general form of an up-to-date American country elevator.

The elevating and cleaning machinery are the same as for the larger elevators already described, only on a smaller scale. According to my observations, there are between 15,000 and 20,000 of these elevators in the United States, some single States containing nearly 2,000. These elevators are owned by various elevator companies, which compete with each other in the liveliest fashion. The country elevators are the main feature of the American elevator system. They handle all the wheat raised east of the Rocky Mountains, and some of that raised on the Pacific Slope, while the terminal elevators of large size handle only the grain that is exported. Very much more capital is invested in these country elevators than in the large terminal elevators. I have seen scores of small towns having three to four of these small country elevators each—in fact, this is about the average number per railway depôt in North Dakota and North Minnesota. Plenty of country towns contain six or seven, and I am informed that the little town of Eureka, South Dakota, possesses no less than thirteen. Of course, each elevator under such circumstances represents a different owner, except where, as is not seldom the case in larger country towns, one company has two or more elevators in the same town.

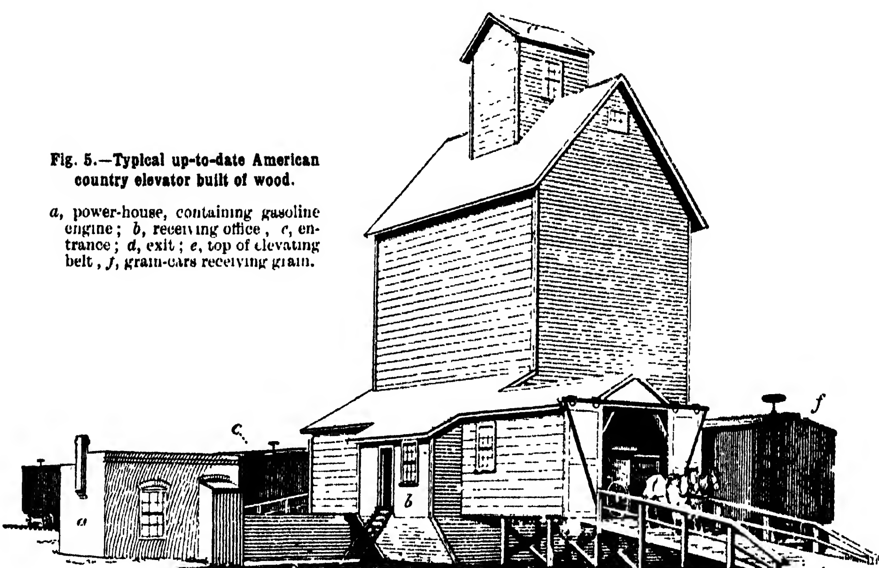


Fig. 5.—Typical up-to-date American country elevator built of wood.

a, power-house, containing gasoline engine; *b*, receiving office; *c*, entrance; *d*, exit; *e*, top of elevating belt; *f*, grain-cars receiving grain.

Grain-waggons.

Many small producers in the more thickly populated parts of Minnesota and other north-western States carry their grain to the elevator in bags on any suitable waggon. They have, of course, to unbag it themselves at the elevator. The larger producers in the less thickly populated districts carry their grain in "tank-waggons," as they are sometimes called. This method of transportation is considerably cheaper than that mentioned above. These

grain-waggons, having a capacity of 1 ton to 3 tons, can be bought for about 50 dollars. The top boards are removable, leaving the waggon in shape for

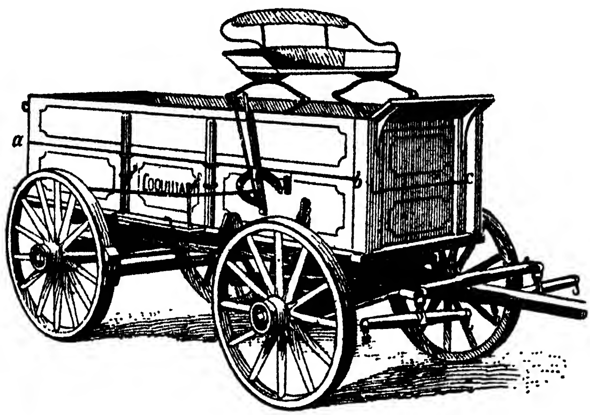


Fig. 6.—Typical grain-waggon as used in Minnesota, Dakota, and other middle United States where wheat and maize are the chief products.

The side-boards of this waggon are easily removed. The top halves of the side-boards are removed separately. That part above the line *a*, *b*, *c*, can be so removed, thus converting the waggon into a kind of express waggon. The back end of this waggon is provided with a small slide door, through which the grain in the waggon will run out when required.

other farm work. The price of labour, horses, feed, and waggons being about the same as in New South Wales, as are also the roads and distances in those

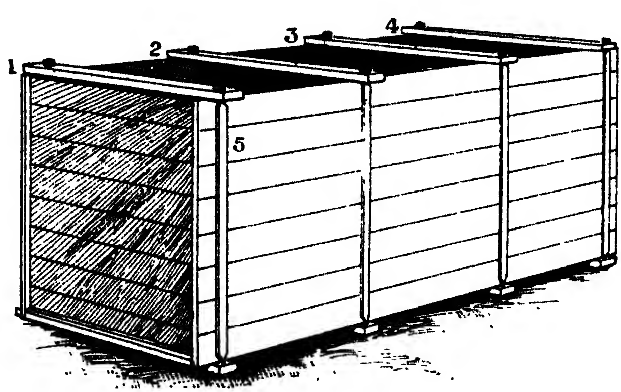


Fig. 7.—Wooden box such as is provided by farmers in the United States for carrying loose grain from the field to the elevator.

This box is made of ¾ inch matched pine. 1, 2, 3, and 4 are pieces of pine 2 inches by 4 inches, and are held in place by flat iron rods 1 inch by ¼ inch, each rod having a thread and nut at both ends, as shown at 5. These boxes range in size up to 4 feet x 4 feet x 12 feet. The farther end of this box carries a slide door near the bottom, from which the grain in the box runs out when required. This box is to be bolted on to a waggon or dray.

parts where these special waggons are used, the price per mile for haulage is about the same as in New South Wales.

Instead of buying a ready-made grain-waggon, some of the most successful producers of wheat build long boxes, 4 feet x 4 feet x 12 feet, and at threshing-time these are bolted on to the same waggons that at reaping-time are used for hauling sheaves. This seems to me the most practical of all the ways I have seen. The boxes are of common matched board, and are kept from bulging by frame-work at the ends and in the middle. The top and bottom pieces of the frames are 2-inch x 4-inch scantling, and the side-pieces are iron rods $\frac{1}{4}$ inch x 1 inch, held with nut and screw. Such simple boxes can be built for a little more than the cost of the material, and leave the running part of the waggon free for a wider variety of uses on the farm than would otherwise be the case, and may be built to fit any waggon or dray.

Grain-cars.

The ordinary American freight-car is of box form, having two sliding doors on opposite sides at the middle of the car. Several styles of these cars are in use in America. The width of these cars is 9 feet overall. The inside dimensions are 29 feet to 34 feet x $6\frac{1}{2}$ feet to 9 feet x 8 feet (width). They are made in a variety of forms, with or without air-brake, with a variety of running gear and to carry from 20 to 35 tons, sheathed inside or not (the latter seldom), &c. When made for the so-called grain-lines they differ but little from the cars on lines that carry miscellaneous freight—in fact, the bulk of the grain-crop is transported in a few weeks, and all railway-lines find it better to use a general purpose car. The accompanying plate shows in detail the peculiarities of the grain-car as used on American railroads. The dimensions, weight, and capacity is given, as well as the cost. The price is for the spring of the year 1900. It is necessary to bear this in mind, as the prices vary somewhat with the price of materials. A car-load is reckoned at 800 bushels.

Bag System.

The sacks now used for grain in California, Oregon, and Washington are calculated to hold about 100 lb. of wheat. They are of lighter material than the New South Wales wheat bag. The price paid on the Pacific Coast in 1899 averaged 6 cents. They are universally sewn. This Pacific Coast size of bag is, in my opinion, more convenient to handle than the larger Colonial size. I have watched the various loadings and unloadings incidental to the Californian wheat traffic, and consider that they are accomplished both more economically and more expeditiously than similar operations with the larger Australian bag. There is no special machinery for handling bagged wheat; it is all done with the aid of gangs of men. At the Stockton and San Francisco warehouses for wheat, it is customary to shoot the bags of grain from the second storey delivery, after the manner of many Sydney warehouses, by means of a slanting wooden shoot, which delivers, 5 feet from the ground, either on to waggons or on to ordinary hand-trucks, which latter receive five bags one above the other, and under the guidance of unskilled labour, are wheeled aboard the boat or train. Taking into account the cost of bags, this

Fig. 8.—New York Central Box Car. ~900.

Capacity .	60,000 lb.	Sill to plate	6 ft. 11 in.	Height, floor to carlin	7 ft. 1¼ in
Length over sills .	35 ft.	Length inside	34 ft. 4¼ in.	Height at eaves .	11 ft. 5¾ in.
Width over sills .	8 ft. 10 in.	Width inside	8 ft. 3¼ in.	Width at eaves ..	9 ft. 6¾ in.

method of handling grain is much more expensive than by means of elevators, except where only very small quantities are to be handled. That the Californians are successful exporters of wheat is not on account of the use of bags, but in spite of it. It is a handicap they have carried by virtue of their flat areas, peculiar climate, and wonderful harvesting machinery.

Apart from its economy in the handling of grain, the elevator has introduced accuracy into the grain trade. The element of uncertainty connected with such an irregular commodity as wheat bagged in the field is absent from elevator grain. It is a disadvantage to trade when the commodity concerned is irregular in quality, and the weight of the disadvantage generally rests on the seller. It is this fact, I am informed by a good authority, which has led to the construction of elevators in England, such as that recently erected on the Manchester Ship Canal, where wheat is unbagged as received from foreign parts other than the United States, and, after being graded in

Fig. 9.—Placing a portable elevator on board a vessel which is to be unloaded.

The elevator is shown at 7; half a dozen men are engaged, with the aid of the ship's tackle, in hoisting it aboard.

the elevator, is actually rebagged in order to be reshipped, as required by the railway trucks in use in England, which, for the most part do not carry in bulk.

The handling of grain at seaports, previous to despatch from producing countries, and on receipt in consuming countries, has given rise to special machinery adapted to loading and unloading ocean-going vessels, such as portable elevator machinery, grain-barges and elevator barges; all these are appurtenances of the grain wharves or grain-carrying ships, and are so many separate adaptations of the elevator principle.

An examination of the accompanying illustrations, which the writer has secured at some of the world's principal grain ports, will reveal the nature and great practical utility of these contrivances. They are, in a word,

modifications of the elevator bucket and grain-belt, suitable to unloading and transhipping, and consist of small lightly constructed, and therefore portable grain-elevators and grain-carriers.

As a specific case, let us take the unloading of the steamship "Friesland," at the wharf of the Red Star Line in Antwerp. She is laden with maize, and has to discharge her present cargo into canal-boats for various parts of Belgium, into bags for local consumption in Antwerp, and on to the wharf to await sale and transportation.

Fig. 10.—Apparatus for elevating and weighing the grain on board a ship.

1, top of elevator; 2, drive wheel of the elevator, worked from the ship's machinery; 3, hopper receiving grain from top of the elevator; 4, grain belt leading to the weighing-bin; 5, 6, 7, spouts from the weighing-bin; 9, sheet-iron weighing hopper suspended from one end of the steelyard, 8; 10, spouts leading over the ship's side to canal boats; 11, weights (bagged up) on other end of steelyard, 8; 12, a grain belt not in use, and standing on edge.

The elevator buckets, carried on endless bands, are enclosed in tubes of sheet steel $2\frac{1}{2}$ feet square, and long enough to reach from the hatches of the ship to the bottom of the hold. These are sufficiently light to permit half a dozen men, with the aid of the ship's tackle, to place them in position in about half an hour. One of these portable elevators is seen in Fig. 9. The workmen are shown in the act of raising it from the wharf to the deck. The

lower end of the elevator is still resting on a wharf trolley, while the other end is concealed by the ship's top hamper.

Light steel girders are fastened across the hatch in pairs, and to these the elevator is clamped in an upright position. The power for working the elevator is supplied by the ship's steam winch. Two such elevators are usually placed on each hatch, and five pairs of elevators may often be seen working simultaneously on a single vessel's cargo. The vessel itself, constructed especially for a composite trade, including grain, has her hull divided by half a dozen permanent transverse steel partitions, and the compartments thus created are, during loading, again divided longitudinally, *i.e.*, lengthwise the ship, by temporary partitions of 2 inch wooden plank.

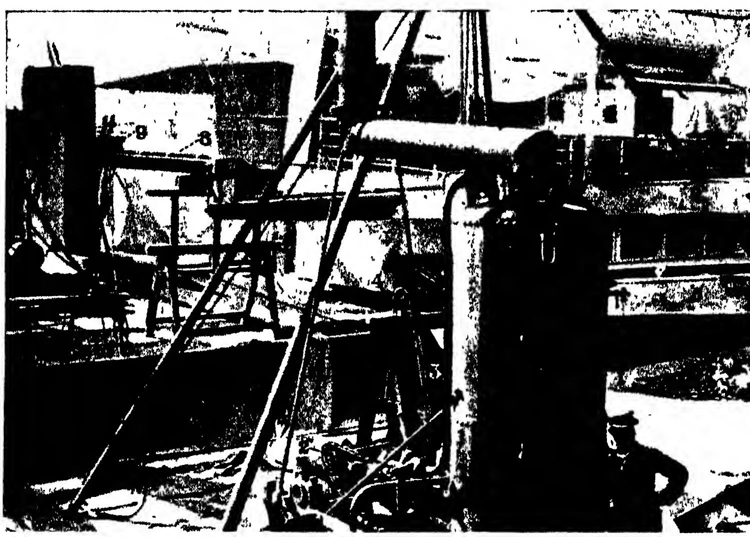


Fig. 11.—Dock Scene, Antwerp: Unloading American maize from S.S. "Friesland."

1, portable engine used to work the train of grain belts; 2, driving chain of engine; 3 and 4, driving chain of the grain belt, 5; 5, sheet-steel frame of a grain belt; 6, another frame and belt which delivers on to 5, 7, the hopper of 6, 8, the belt which delivers on to 6 through 7, 9, the hopper of 8 · 10, top of the elevator which is working at one of the ship's hatches. The grain belt, 8, is worked by the steam of the ship, but, beginning with 6, all the other grain belts in the series are worked by the dock engine, 1. See Fig. 12

Toward the top of the grain cargo the holds may be still further subdivided by temporary wooden partitions as an additional precaution against "shifting" during the voyage.

The grain buckets are about 10 inches deep, 6 inches wide at the top, and 1 foot or more long. They are worked at such a speed that when they turn over the top pulley the grain is thrown into a spout, which delivers on to a canvas grain belt, supported in a light steel frame, and driven by the same motor that drives the buckets.

These canvas grain-carriers are well shown in the various illustrations, and it will be seen that they deliver the grain either into elevated wooden hoppers, from which the grain may be weighed out into bags, or into spouts which lead to canal boats, which are to deliver the grain inland, or they may be joined end to end and deliver the grain in piles on to the wharf floor.

In this latter case a portable engine is set up on the deck and utilised to run the necessary series of carriers. As shown in Fig. 11, the lower end of one of the carriers rests on wooden horses near the engine, and receives the driving chain at that point. This carrier drives the next, and that in turn drives a third, and so on to the point of delivery. The various carriers are hung from tripods of tubular steel by means of rope and tackle.

The details of weighing and bagging are shown in Fig. 12. Cubical wooden hoppers, about 4 feet deep, receive the grain from the carriers. These wooden hoppers deliver on each side into square sheet-iron hoppers, each holding a bag of grain, and hung on one end of a steelyard. As soon as the

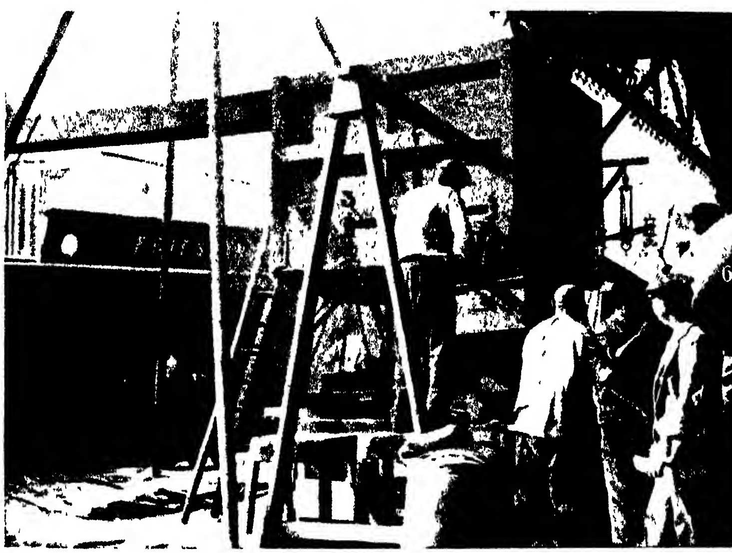


Fig. 12.—Weighing out grain on the dock at Antwerp.

1, grain belt coming from the ship's elevator; 2, receiving bin into which the belt pours its grain, 3, steelyard; 4, weighing-hopper which has just been emptied into the bag marked 5, 6, bag which has just been lifted to a labourer's shoulders.

steelyard shows the correct weight, a slide in the bottom of the sheet-iron hopper enables the weigher to deliver the weighed grain into a bag attached below.

In delivering to a canal boat the large wooden hopper may or may not be used. The grain belts are competent to deliver at once into sheet-iron spouts which lead from the ship's rail down into the canal boats; these spouts are tubular and jointed every 10 feet or thereabouts, so as to be somewhat flexible, and they allow, by additions and disjointings, for the rise of the ship in unloading, or any relative displacement of the ship and canal boat. All these details may be studied out in the illustrations.

The punts and canal boats used to carry grain in port, or on quiet waters, have a deck and a number of hatches, as pictured on Fig. 15, showing the unloading of grain punts at Liverpool.

In American ports the grain punts have become more highly specialised

Fig. 13.—Transferring grain from a steamship to a canal boat.

1, engineer working the elevator; 2, elevator; 3, grain belt, 4, hopper into which the belt delivers its grain; 5, 6, steelyard and weighing hopper. 7, 8, spouts leading from the weighing hoppers to the hold of the canal boat.

than elsewhere. There small elevators may be seen built on to the centre of punts used for no other purpose than the transportation of grain. The interior

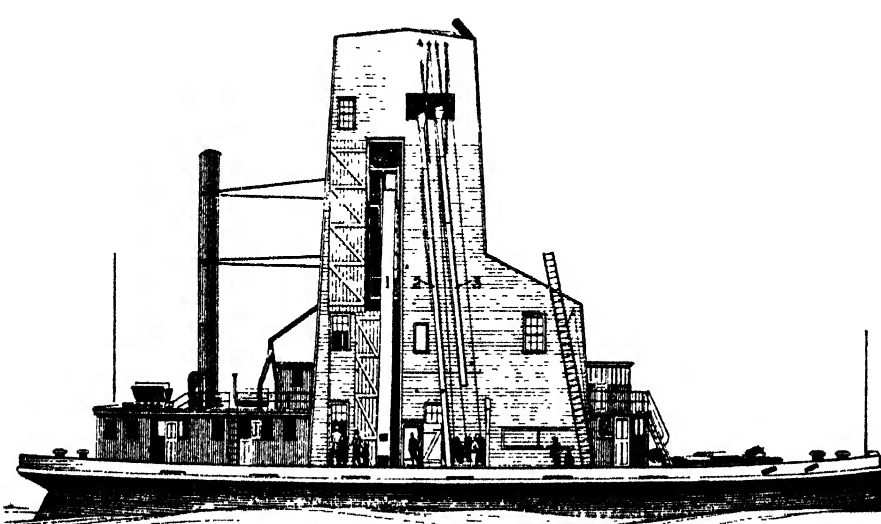


Fig. 14.—A punt-elevator—that is, a grain punt on to the middle of which an elevating machine has been built. These boats are used in New York and other American ports.

1, the elevating belt; 2, and 3 the spouts which by means of tackle are lowered into the holds of large steamships. These spouts when in position take the grain from the top of the elevating belt, 1. The interior of one of these punts is arranged so as to deliver all the contained grain to the foot of the elevator, 1.

of these punts is arranged to deliver the cargo to the foot of the central elevator, and the latter is tall enough so that tubes from its top may be lowered into the hatches of the largest ocean-going steamers.

These great vessels must be run with the utmost regularity, and must be detained in port as little as possible; accordingly the punt-elevators, as they may be termed, are built to cater to the necessities of these big steamers.

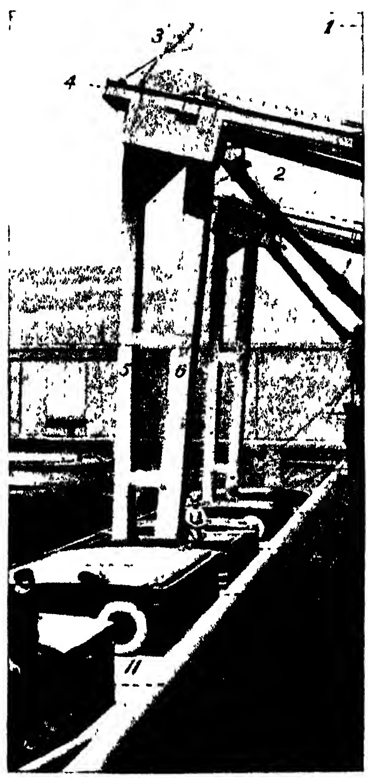


Fig. 15 --Punt being unloaded at a European elevator located at the Docks. The hatches of the punt are shown at 7, 8, 9, 10.

1, the side of the elevator building; 3, tackle by means of which the arm, 4, is raised and lowered; this arm is pivoted to the frame-work of the building; 5, 6, the elevator-leg dipping into the hold through the hatch, 8. The buckets are descending through 6 and rising loaded with grain through 5. The grain goes into the elevator through the spout, 2.

All the ship's officers have to do is to open the proper hatches—the punt elevator does the rest. Neither the deck nor the wharf of the ocean leviathan is cluttered up with grain and machinery as would otherwise be the case, and furthermore her grain cargo is placed on board with a maximum of speed, no time being lost in erecting and adjusting temporary machinery. A punt-elevator is pictured in Fig. 14.

(To be continued.)

Experiments with Suffolk and Lincoln Cross-bred Sheep at Glen Innes Experimental Farm.

Mr. R. H. Gennys, Manager of the Experimental Farm, Glen Innes, in a series of reports on the crossing of Lincoln and Suffolks with Merinos carried out under his supervision during the period November, 1904, to 14th January, 1906, supplies the following information :—

Five lambs of each breed were weighed on 4th December, 1904, at 1 month old. The Suffolk-Merino cross then exceeded the Lincoln cross by 4 lb. per head. At 3 months old, on 4th February, 1905, these lambs were again weighed, and gave the following returns :-

At 3 months :-

Lincoln-Merino.			Suffolk-Merino.		
lb.	lb.		lb.	lb.	
58	55		64	59	
56	52		63	58	
56	-		63	—	
	277			307	
Average ...	.	$55\frac{2}{5}$	Average ..	..	$61\frac{2}{5}$

Thus five lambs of the Suffolk-Merino cross have exceeded the Lincoln-Merino cross at 3 months by 6 lb. per head.

These lambs received no artificial food, and are all running in one flock. This experiment, so far, goes to prove that this new breed Suffolk Down sheep is going to be of much value in raising early-maturing lambs for market purposes. It was noticed that the tails of the Lincoln cross carried much more fat this time than the Suffolk cross ; in bone they appear about equal : the Suffolks, however, appear to have superior length of body, which may account to some extent for their heavier weights. It will be only after being killed and eaten that a knowledge of how the fat and lean is carried, and whether it has the excellent flavour claimed for the breed by its advocates in England. On 4th March, at 4 months, these five lambs of each cross have again been weighed :—

At 4 months :—

Lincoln-Merino.			Suffolk-Merino.		
lb.	lb.		lb.	lb.	
$68\frac{1}{2}$	68		74	78	
72	$70\frac{1}{2}$		75	$74\frac{1}{2}$	
69	——		$71\frac{1}{2}$	——	
	348			373	
Average ...	...	69·6	Average ...	...	74·6

The Suffolk-Merino lambs at 4 months old thus exceed the Lincoln-Merino lambs of the same age, and under the same conditions, by 5 lb. per head.

It is noted that during the last month the Lincoln-Merino cross has gained an average of 1 lb. on the average weight of Suffolk-Merino, which at 3 months averaged 6 lb. heavier than the Lincoln-Merino cross. But the superior growth of wool in the Lincoln-Merino cross in a measure accounts for this. The general average is admitted here to be very good, and the Suffolk-Merino ewe lamb that weighed this time 78 lb. will be hard to beat by any Merino cross-bred of the same age; at 1 month old she weighed 37 lb.; at 3 months old she weighed 64 lb.; thus during this month she has gained 14 lb.

I can venture the opinion now that our new cross will prove excellent for producing early-maturing lambs, as far as good weights are concerned, but it remains to be seen how the butcher will take to them.

The periodical weights of lambs and hoggets have been continued, at 13 months.

Suffolk-Merino Hoggets, 13 months old.	lb.	Lincoln-Merino Hoggets, 13 months old.	lb.
Ewe hogget ..	131	Ewe hogget	116
Wether ,, ...	130¼	Wether ,, ...	119
,, ,, ...	129	,, ,, ...	120
14½ months old.		14½ months old.	
142 lb.		136 lb.	
139 ,,		128 ,,	
137 ,,		127 ,,	

These sheep were lambed at the same time, and have been running together under exactly similar conditions throughout, so the comparison is fair in every respect. Depastured on natural grasses, with the exception of two or three weeks, the whole time.

Suffolk-Merino Lambs, 3 months old.	lb.	Shropshire-Merino Lambs, 3 months old.	lb.
Ewe lamb	69¾	Wether lamb . ..	65¼
Wether ,, ...	70¾	,, ,, ...	64
,, ,, ...	72¼	Ewe ,, ...	66
4 months old.		4 months old.	
86 lb.		75 lb.	
81 ,,		70 ,,	
84 ,,		69 ,,	

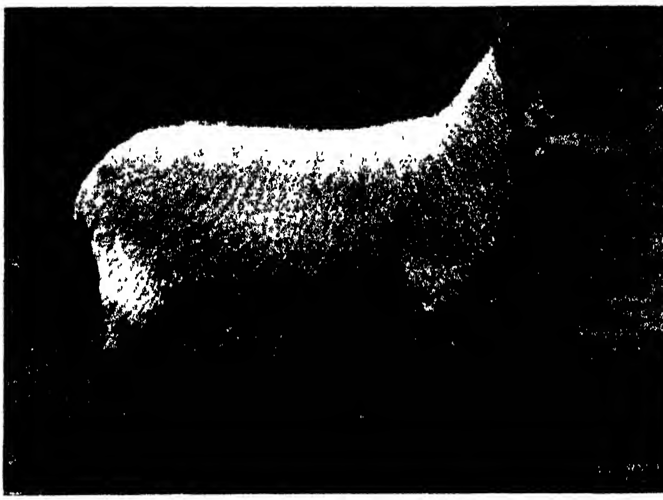
These lambs born at the same time, they and their mothers running together ever since under exactly similar conditions, are comparable in every respect. Even at this early age, supposing dead-weight is only half (and it should be a little more), they are nice weights for export.

Romney-Merino Lambs, 3 months and 1 week old.	lb.	Lincoln-Merino Lambs, 2 months and 2 weeks old.	lb.
Ewe lamb	65¾	Wether lamb... ...	58¾
Wether ,, ...	65	,, ,, ...	62¾
,, ,, ...	69	,, ,, ...	59¾
4 months old.		Lincoln-Merino Hoggets.	
79 lb.		Have not reached 4 months old, so not comparable.	
82 ,,			
80 ,,			

These last two crosses were weighed on the same day, but are not strictly comparable, on account of their ages.

The pure-bred Suffolk ram, in February last, scaled 260 lb. A Suffolk-Merino lamb, 4 months old, and Lincoln-Merino lamb, same age, were slaughtered by butcher. The Suffolk-Merino lamb weighed 40 lb. dead-weight, and the Lincoln-Merino 32 lb., a difference of 8 lb. in favour of the Suffolk-Merino cross. The mutton of the blackfaced lamb being pronounced excellent—the fat and lean being well distributed throughout.

Wool from Lincoln-Merino hoggets ...	...	8 lb. 2 oz.
„ Suffolk-Merino „ ...	...	7 lb. 9 oz.



Pure Suffolk Ram, 8 years old, weight 260 lb., sire of Suffolk-Merino lambs mentioned in Report. Property of Department of Agriculture, Experimental Farm, Glen Innes.
(Photographed after shearing.).

Undoubtedly, so far, the Lincoln-Merino is a heavier wool-producer than the Suffolk-Merino; and in fleece, wool fetched ½d. per lb. more, and in the pieces, locks, &c., still more, the value of the wool of the Lincoln-Merino hoggett being 6s. 1½d., and the Suffolk-Merino 5s. 2d. per sheep. These hoggets were under 12 months old when shorn.

The wool of each of the crosses was much improved by the Merino blood. The small number of bales, however—as it had to be sold in the Star lots—prevented the best prices being obtained.

As mutton sheep, however, the Suffolk-Merino, both as lambs and hoggets, have all the best of it; and it is to find out the best sheep and lambs for export that is chiefly aimed at in these experiments.

It is pointed out that, with good feed, these crossbreds would, at from 12 to 15 months old, produce sheep of say 60 lb. dead-weight; it would take a 4 or 5 years pure-bred Merino all his time to go that, and the lambs would at 4 months weigh, say, 35 lb.; each of these are good weights for export. This would be turning over money quickly, and should suit our farmers well. It is early yet in this experiment to say much of the Romney and Shropshire crosses; the former are weighing well, and the Shropshires are very taking to the eye. The mothers of the lambs and hoggets above mentioned are good class, middle-sized Merino ewes, and they are fair cuts from the same flock.

An Interesting Record in the History of Agriculture in New South Wales.

James Ruse,

To whom the first land grant in New South Wales was made.

The first harvest recorded in New South Wales was in 1789. Governor Phillip makes this report of it in a despatch to Lord Sydney dated 12th February, 1790:—

"In December, the corn at Rose Hill (now Parramatta) was got in; the corn was exceedingly good. About two hundred bushels of wheat and sixty of barley, with a small quantity of flax, Indian corn, and oats, all which is preserved for seed." [Historical Records, Vol. I., Part 2, p. 299.]

This crop was a poor one, and Phillip was dubious as to whether the cultivation of the soil would ever return sufficient to repay the labour expended. In November, 1789, the opportunity he was waiting for presented itself—one James Ruse, who claimed experience in husbandry, was given a trial "upon an acre of cleared and prepared land on the right bank of the Parramatta River, where the town now stands. A hut was built for him; seeds, implements of agriculture and a small quantity of live stock were provided, and he was allowed clothing and provisions for twelve months from the public store. As a spur to his industry he was promised that if he behaved well he would receive a grant of thirty acres on the site where his hut stood. . . . . . Phillip doubted whether the man would be so successful as he anticipated, but thought that he would 'do tolerably well' after he had been supported from the public store for eighteen months. Ruse, however, was as good as his word. In November, 1790, when he had been twelve months on his farm, Tench interviewed him concerning his antecedents and the progress he had made. He had at that time an acre and a half of 'bearded wheat,' half an acre in maize, and a small kitchen garden. The wheat, which he expected to go about eight bushels to the acre, was sown in May and June, the maize in August and September.

* * * * * * *

"Ruse had fairly earned his reward, and on 22nd February, 1792, Phillip signed the first land grant executed in Australia, making Ruse the proprietor of thirty acres of land. The allotment, which was situated on the south of the 'Ponds,' at Parramatta, was named 'Experiment Farm' in the grant, which thus became a record of the success which had attended Phillip's first effort in land settlement.

"The boundaries of the grant can still be traced. The farm faced a small tributary to the Parramatta River known as Clay Cliff Creek. It now forms a part of Anderson Ward, in the Borough of Parramatta, and lies about twelve chains in a southerly direction from the public wharf at the foot of George-street: it is bounded on the west side by Harris-street, on the south by Brisbane-street, and on the east by Elizabeth-street. The land was sold by Ruse to Dr. Harris, of the New South Wales Corps, by whom a

cottage which still stands (1894) was built upon it, and called 'Experiment Cottage,' a name it still bears. The part of the land which Ruse first tilled is now a large vegetable garden cultivated by Chinese." [Extracted from the History of New South Wales from the Records, Vol. II, by Alex. Britton, edited by F. M. Bladen.]

From this it would seem that wheat was cultivated by Phillip previous to James Ruse, unless Ruse was employed by Phillip in preparing the crop

mentioned by him. If he was, his claim to have sown the first grain, as set out on his tombstone, which is reproduced here, may be true ; anyway it is certain James Ruse was the first settler to grow wheat, as shown by the records. The inscription on the headstone is as follows :—

I.H.S.
Gloria in Axcelsis.
Secred
to the memerey
of James Ruse, who
departed this life
Sept. 5, in the year of
houre Lord, 1837, natef
of Cornwell, and arived
in this coloney by the
Forst Fleet, aged 77.
My mother rearead me tenderley,
With me she took much paines ;
And when I arived in this coloney,
I sowd the forst grain ;
And now with my Heavenly Father,
I hope for ever to remain.

This can be deciphered in the illustration of the tombstone. The illustration is from a photograph taken by the Government Printer.

Pure-bred or Cross-bred Sires for Dairy Cattle.

The experience of all successful dairy farmers is that it pays best to always use a pure-bred bull, no matter whether the cows are pure-bred or otherwise. When a cross-bred bull is used it is possible he may get heifers that will be good milk-yielders, provided his sire and dam have come of good milking families. The great defect of cross-bred bulls, however, is that they are seldom able to reproduce in their offspring the good points which they themselves appear to have, and hence they are extremely defective. An ill-shaped, well-bred bull will often produce better stock (when mated with cross-bred cows) than a well-shaped cross-bred bull. Breeding from cross-bred bulls prevents any special type of animal being aimed at, as we never know how cross-bred bulls will throw, and very often a big percentage of their stock are ill-shaped and unprofitable. The practice of using cross-bred bulls is, therefore, to be discouraged.—M. A. O'Callaghan.

Farmers' Fowls.

[Continued from page 124.]

G. BRADSHAW.

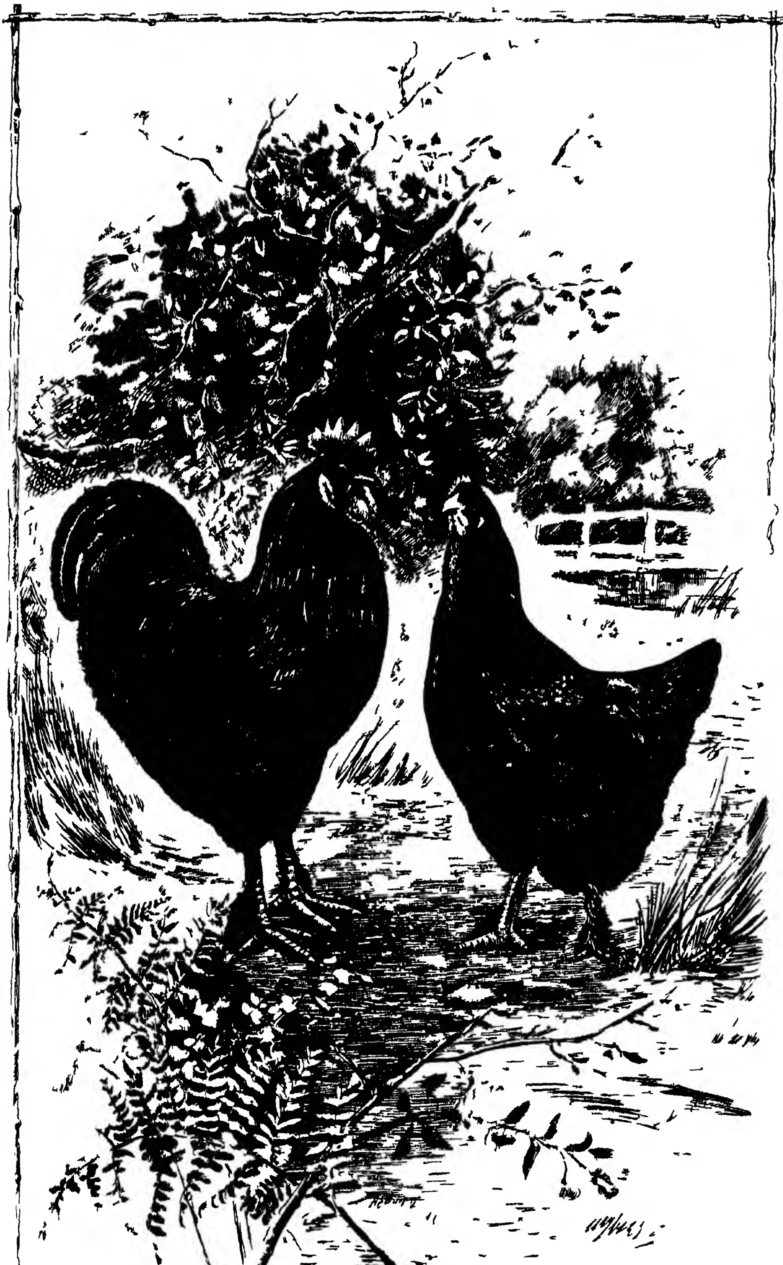
CHAPTER XXIX.

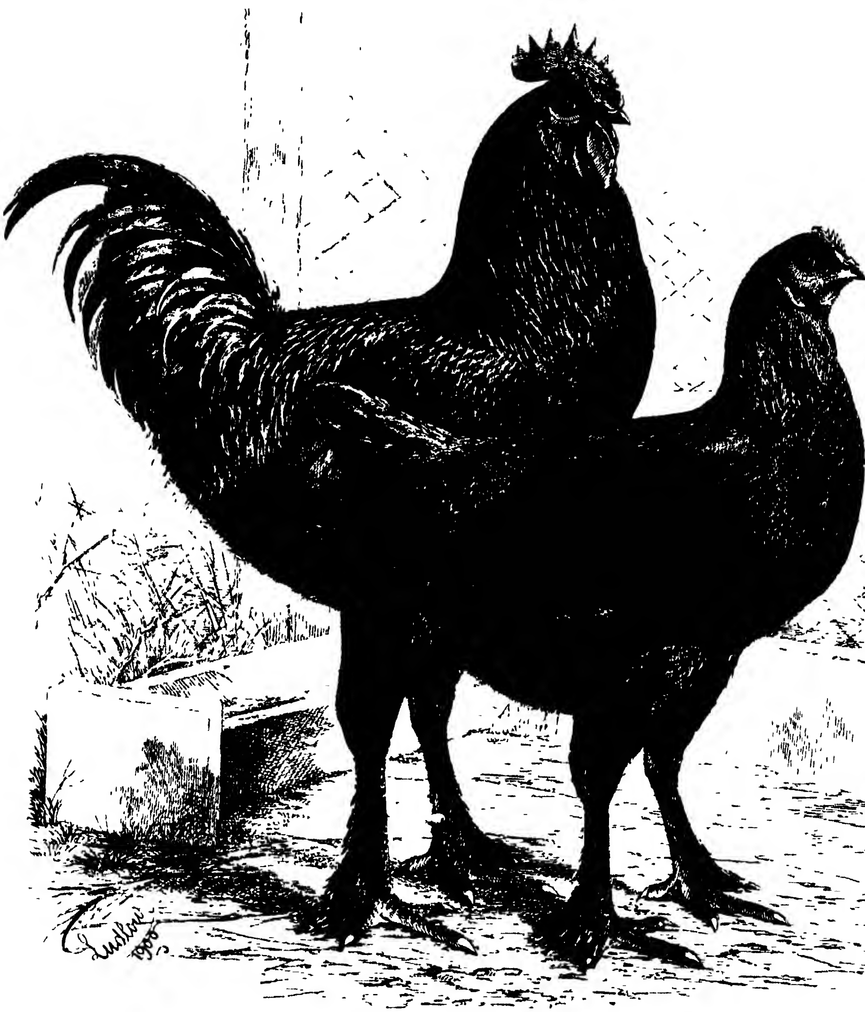
LANGSHANS.

No other breed of fowls for a continuity of years has received such prominence through dispute and discussion as to type, purity, &c., as has that known as Langshans. The first arrivals of the breed in England were received by Major Croad, in 1872. They came from a district named Langshan in China. They were shortly afterwards exhibited, and the general impression then was they so much resembled Cochins that the writers of the day described them so, and the acrimonious discussions which have since arisen have been on this subject, and as a means to an end and finality in the dispute, English Langshan breeders have for a lengthened series of years been breeding them much more lengthy in limb than the Cochin, until the present day when the modern or exhibition Langshan has the distinction of being the tallest of domestic fowls; this lankiness or reach being that of limbs only, for the Langshan as at present known, although of apparent greater size, is actually no heavier than the short-legged bird of the early eighties. The breeders of this modern type press their claims for this legginess and sparse feathering on the grounds of getting away as much as possible from the Cochin which the early specimens so much favoured; however, the short-shanked, clumsier type had many advocates, and from a few years after the Croad importations, through these differences, Langshan breeders have been divided into two camps, and hostile ones at that—the Croad advocates charging the other side with using Game largely to get the length of limb, the birds then by inference being cross-breds, while for the type favoured by themselves they are termed "pure Croads."

These breeders of the original type have of late years increased so largely that a club has been formed to preserve and encourage the breeding of the short-legged, big-bodied variety, with the result that there are now two standards for Langshans—the Croad type, the other one being that seen of late years at the Australian Shows, the "reachy" or as some English breeders term them "the Society type."

From 1878 classes were provided at a few English shows for Langshans, but for some years they made little headway, but once they became fairly well known in England they reached Australia. The first pair exhibited at any show in this State was at the New South Wales Poultry and Pigeon Society's Sixth Annual, held in the Temperance Hall, Pitt-street, Sydney, on 7th August, 1883. They were exhibited by Mr. J. W. Cumming, of the Sewage Camp, Bondi.





MODERN LANGSHANS

The breed being hitherto unknown had no class provided, and were shown in the "any other variety class." In the following year, 1884, a class was provided at the same Society's show. Four entries appeared contributed by Mr. Cumming, and Mr. W. H. McKeown, of Gordon; the latter gentleman being a consistent breeder, importer, and exhibitor of Langshans until he retired from the fancy a few years ago. Mr. McKeown spent well nigh £200 in importations of this breed alone. As there were neither Orpingtons or Wyandottes at that period, and the Dorking and Spanish considered then as now, delicate, the Langshan appealed to both farmer and fancier alike as a good utility fowl, and in the space of a few years from the time the single exhibit appeared the numbers had reached up to 50, while coming up to 1895 and 1896 the exhibits ran up to 100, as many as 38 and 40 cockerels appearing in one class. This was about the record year, and from that period to the present day the numbers have dwindled down at every show in Australia, rarely more than a dozen appearing at the Sydney shows, while at many agricultural exhibitions throughout the country the breed has altogether disappeared. The large number of exhibits and exhibitors, the keen competition and excitement over the judging, and the big prices given for the winners, being, as far as this breed is concerned, a thing of remembrance only.

This decadence in public favour has to some been a subject of much wonderment, from the fact that the Langshans were undoubtedly good utility fowls, layers of large quantities of average size brown eggs, while as table poultry they were really excellent, big in frame, white in flesh, hardy and good thrivers; however, the patrons of the short-legged, flowing-tail, full-breasted Langshan of the eighties, who witnessed its evolution to the giraffe type of the present day, have no hesitation in saying that this changing in type very much affected the profitable qualities of the breed, and that realising this, fanciers and utility men alike dropped it in favour of newer breeds then appearing in the horizon of the fanciers' world, the Wyandotte and Orpingtons, length of limb in either breed being a show-pen evil, and considered detrimental to an all-round useful fowl.

In 1894, Mr. S. Gray, then sub-editor of the *Agricultural Gazette*, had a short article in the August number on this breed of fowls, the pair which illustrated it being drawn from photographs supplied by a then prominent breeder, Mrs. W. H. Webb, of Bathurst. The male bird won at New South Wales Society's Show in 1893, the hen being a winner of the previous year. The illustrations, which are reproduced, it will be seen, would do duty for third-rate Black Orpingtons of the present day, and is confirmatory of Cook's statement that he used Langshan blood largely in the manufacture of the Orpington. Indeed if such a bird as that illustrated was available at the present day, there are breeders in this State, who by selection and scientific mating, could in a very few years produce some of the modern Orpingtons.

As already shown, the blocky feathery type was the original Langshan; at the same time, breeders here, as elsewhere, in order to get away from the Cochin type, did not object to a slight lengthening

of the limb and shortening of the feather, and so long as the birds kept within reasonable bounds in this respect their popularity increased to an extent that at the time before mentioned Langshans were the most popular fowl in Australia. But as each succeeding year witnessed increased length of leg and reachiness, and those possessing this to the greatest extent being favoured by the judges, breeders called a halt, with the result that the one-time plentiful and profitable feather-legged black fowl is neglected to an extent that less than half a dozen breeders now patronise the show-pen with this over-much modernised breed of fowls. So far in this article I have confined myself to the ups and downs of the Langshan in the show-pen; however, that does not tell all about a breed of fowls. The original Cochin-looking importations, and even later considerably modified arrivals, were all good layers and excellent table fowls, carrying plenty of white meat; and these merits soon got talked and written about, with the result that a large bulk of the suburban poultry farms stocked Langshans, and a good many farmers did likewise, so much so that ten or fifteen years ago the poultry saleyards had a large proportion of these bulky fowls offering at their weekly sales, the egg market also showing evidence of the Asiatic blood, there being then a larger percentage of the chocolate-coloured eggs offering than appears at the present time. However, despite the decadence of the breed as an exhibition fowl, and the abandonment of it by the utility breeders, quite a number of the early patrons of the Langshans continue it as their only breed, or if more than one breed is kept, Langshans constitute one of the kinds. Those referred to are largely the old style Langshans, and although their now patrons would not think of exhibiting them with the expectation of winning prizes, they have great faith in their laying qualities, and, unlike the Plymouth Rock breeders, have ventured them in almost every laying competition, and with results eminently satisfactory.

At the Hawkesbury College 1903 competition, commencing in April of that year, seventy pens competing, two of these consisted of Langshans, and owned by Messrs. W. H. Ponton, of Tuggerah Lakes, and E. J. Winton, of Campbelltown. The six birds of the former owner laid in the twelve months 1,195 eggs, or within five of 200 each hen for the year. This pen came in sixth in the competition, beating sixty-four lots, including every breed and variety, and were within two eggs each of the well-boomed Mrs. Hansel's American Leghorns; while as an effective set-off to this trifling shortage, the Langshans' eggs weighed 26½ oz. to the dozen, while those from the American birds scaled only 24 oz., thus showing that the Langshans produced two or three pounds' weight more per hen than did the Leghorns, which produced a few more in number. Still, one pen of fowls amongst seventy, no matter how good a performance, is not a correct way to test production, and this was evidenced by the other competing pen of Langshans, they finishing in the forty-third place, the six birds laying 902 eggs; and here again the eggs were large, weighing 26 oz. to the dozen. The average of the two pens of Langshans were within a fraction of 175 eggs for each hen, considerably above either the

White, Silver, or Gold Wyandottes, and the Orpingtons as well. However, it does not do to run away with some perhaps chance records on which to base assertions; and from the inception of these competitions I warned many to be specially careful about using a single test or individual pen to prove anything, and every competition held since the first all emphasise that there is no breed of fowls which can be safely termed the best layers. Strain is the principal feature, as all tests have shown; and while this may be questioned by a few as a determining point in egg production, every competition has overwhelmingly proved that strain governs production. Instances, of course, can be quoted where certain breeds did well in one test, and failed in the following. Such, however, is most easily explained. Very few breeders in Australia keep their strains intact—one illustration will suffice for many: A breeder whose fowls occupied a very high place in one of the competitions, the birds being of very mediocre appearance, so far as representing the breed was concerned, marking and type most indifferent, immediately made importations to improve the appearance of his stock. Such was the effect, but these new birds were not built for winning prizes at laying competitions, but were the more handsome sort to win prizes in the show-pen. The result is that the progeny have never since occupied a forward place; and, worse still, many of the progeny have gone to every State in the Commonwealth, being purchased and advertised as Mr. ——— prize-laying strain, and already it has been noticed their performances have been most disappointing. The remarkable and unfortunate feature of the incident is the fact that the breeder was unaware that the new birds would affect the laying of this strain, and advertised the introduction of the new blood. Those who have good laying strains of any pure breed of fowls, no matter how far removed from exhibition specimens, should hesitate before introducing new blood to improve appearance, except such be closely related to their own, while those who have exhibition birds of a breed, and which are good layers as well, are doubly blest; and that there are such the numerous laying competitions have shown. Reverting to the 1904–5 competitions, at which test all the breeds laid considerably less than at the previous one, a pen of Langshans secured thirty-third place in the hundred, the eggs again scaling the good weight of 26 oz. to the dozen. The pen of six laid 980 eggs in the twelve months; and again confirmatory of strain, another pen of this breed laid but 702, being within three of the foot of the list, but as a set-off to this the eggs weighed 27½ oz. to the dozen—an extraordinary weight for eggs from any breed of fowls. Coming to the present competition, which began on April 1, 1905, at time of writing the figures are just available to 31st of December, nine months of the test have expired. Of the 100 pens competing, two are Langshans, and both occupy advanced places; one pen (D. Frazer) has laid in the nine months 984 eggs, and occupies the third place in the 100 lots completing. The above is 164 eggs for each hen, and should they not produce another egg in the three months they have made a good record. The second pen (W. H. Ponton) has laid 894 eggs in the same time, which with what will follow in the

balance of the twelve months will be further evidence, were such desired, of the productiveness of the one-time favoured Langshan; nor are the records shown confined to this State, they being still higher in Victoria, for at the first Dookie competition Ponton's Langshans laid over 200 eggs each for the year, and for a considerable time only five hens were competing, which were averaged among the six. Concerning this strain it may be mentioned that the foundation was laid from a setting of eggs purchased ten years ago from imported stock. The birds were then up to the standard, but would have no chance in present-day competition. Mr. Ponton's birds were not only from a good laying strain, but he has consistently kept them up to the laying standard by scientific mating, and excluding foreign blood. Then, again, at the Rockdale competition, Mr. E. J. Winton's pen of six Langshans for the nine months laid 1,038 eggs, being 173 for each hen, a truly wonderful performance, and all showing that Langshans, particularly of the old type, were and are good layers, and that those whose object is big brown eggs, and plenty of them, will not be disappointed by taking up a tested strain of this breed. As table fowls I cannot do better than reproduce what I said of them in 1898. Langshans are usually described as good all-round fowls. They are now bred long in leg, tight in feather, sparsely feathered on the legs, neat combs, and moderate tail, black legs, with white flesh, and layers of good-sized brown eggs. They are hardy, good sitters and mothers, do well in confinement, but either for local market or export are rather slow in developing, thus debarring them from first place for either purpose. Being birds of large frame, the chickens are rather bare of breast meat. The full benefit cannot be had from them until seven or eight months old, and although they are then like young turkeys, it would be questionable whether the price obtainable would pay for the thirty weeks' feed; but, as a fowl for home consumption, and killed at the age mentioned, they cannot be excelled, while for improving the table qualities of Minorcas they have many advocates, but never having had any experience of the cross, I cannot give results.

Mr. J. J. McCue, late poultry expert at the Hawkesbury College, in an article in the *Gazette*, said that Langshans and Minorcas were two good breeds to cross, the progeny being good layers and market birds.

At the English Dairy Show some years ago, when prizes were given for weight rather than quality, Dorking-Langshans won first, and Game-Dorking second. A few enthusiasts, however, practically tested the birds when dead, and found that the Langshan cross lost by drawing and trussing 20 oz., or a fourth of its entire weight; the Game-Dorking cross lost but 15 oz. in offal, thus proving that the Langshan cross was more apparent than real; and in a report on the subject one authority states that we may get large, hardy, and useful chickens for the family from a Langshan cross, but it would not produce a first-class table fowl for the market. In spite of this I am of opinion that they can be usefully employed in the improvement of the poultry of the farm yard, but I prefer those of shorter build than the present exhibition specimens.

Chapter XXX.

DORKINGS AND HOUDANS.

From the very earliest remembrance of all poultry men, Dorkings have been known, spoken and written of, first as an English fowl, and as the basis for the table poultry. Dorkings have been known in Australia from the earliest of our poultry shows, and many importations from England have taken place within the past twenty years, and a number earlier than that. A remarkable circumstance, however, obtains about the breed. No matter how good the specimens imported, the progeny rarely reaches the high standard of the imported parents, and it is most rare to find a breeder who takes up Dorkings to continue long with them. The chickens, it is said, are difficult to rear, and from all the sources from which information on the breed in this country can be obtained, the evidence goes to show that they are unprofitable fowls to keep. One thing is certain: years ago they were fairly plentiful in Australia, and in Sydney in particular, when as many as forty-five or fifty exhibits have been on view at one show, while now the numbers have dwindled down to half-a-dozen. Why this is so, few can tell. If they could be reared in sufficient numbers fourteen years ago to make a big display at the show, the climate has not so changed as to affect the rearing of them. The only explanation, and a reasonable one too, is that, even were the question of delicacy not involved, the birds are unprofitable, and this is the chief reason now-a-days for keeping fowls. The hens certainly are bad layers, and if kept for utility purposes would give a very poor return, while if for market purposes, no matter how prized the breed is for the table, other sorts will show a larger profit. The cocks are certainly to be recommended for crossing purposes, but so few of the breed are now reared, that were there a demand for a dozen good birds, such could scarcely be procured; hence, as a farmer's fowl, it is unlikely they will ever have much call in this country.

Houdans have been frequently called the French Dorking, and always have the reputation of being excellent layers. However, whatever claim the breed has to such distinction in its native land, the English-bred Houdan, as a layer, is worthless, while the massive crests may be ornamental, but certainly not useful. Many show specimens have been imported to this State, but, like their English white-legged, five-toed compeers, have not been a success. Breeders do not take to them, and possibly for the excellent reason that other breeds are more suitable for their purpose.

Chapter XXXI.

GAME.

For a number of years Game occupied a leading position as an exhibition fowl at almost every show in Australia. Indian Game, British Game, and Colonial Game, a dozen years ago, had all large classes, keen competition ensuing. Of late years they have gone the way of a number of other breeds, and have but few patrons. Game fowls, of whatever sort, are proverbially poor layers; this reputation, no doubt,

being responsible for the non-appearance of the breed at any of the laying competitions. All the varieties have excellent table qualities, but the egg handicap is evidently responsible for the way in which they are now neglected. Game chickens, if hatched with and running with a flock of other breeds, with the same food and attention, will at any stage of their growth be covered with the desired breast meat, while the others may be comparatively thin of flesh. Game cocks, whether English, Indian, or Australian, if mated with Orpington or Wyandotte hens, will produce table fowls of the first quality; and already such crosses have reached the London market from this State, and were favourably commented on there. Farmers, however, as a rule, do not care for this experimenting, and perhaps, after all, those that confine themselves to one breed, and make the best of it, can show more profitable returns than do those that keep a number of breeds and crosses. Still, despite the acknowledged poor laying of the Game, the Hawkesbury farmers, orchardists, and others in that wide district, breed the Australian Game largely, and at every auction sale-day in Sydney large numbers of these Hawkesbury chickens are on sale, and usually fetch from one to two shillings more than other breeds. In 1898 I contributed to the *Gazette* an article on Game, as follows, the opinions then expressed still obtaining:—"While the Cornish miners of some thirty years ago were building up a fighting Game cock to take the place of the Old English, and from which evolved the present Indian Game, a remarkable coincidence is the fact that about the same time exactly the same process was going on in the Hawkesbury district of this Colony, the breeds used by the old cockers for the required purpose being almost identical with those used by the Cornishmen. Both parties were working for the common end, namely, good fighting birds, little thinking that a fancier's or show fowl would be the ultimate result of their labours. One great difference between the Hawkesbury and Cornish evolutions is that regarding colour; the birds produced by the miners is a new colour to the fancy, while the Hawkesbury men followed strictly the line of the British Game, producing their favourites in Black-reds, Duckwing, Piles, Brown-reds, Whites, and Blacks. So far as the general build of the birds is concerned, a few years ago the Colonial or Australian Game and those known as Indians were very much alike, large-bodied, strong in bone, hard and close in feather, and carrying a great amount of flesh in the breast; the breed has become a very popular one in this Colony, over one hundred pens frequently appearing at the Sydney shows. Of late yaers, however, the craze for breeding long legs and giraffe necks on Game fowls has been adopted by fanciers of Australian Game, short-limbed specimens having now no chance for show-pen honours, with a natural but sorrowful result of a decline in popularity, and what for its many grand qualities promised to supply a want of a large well-fleshed Game fowl as a foundation for table poultry, has for this cause alone received a set-back in favour of the imported Cornishers with not a single superior quality. Australian Game are now bred to a great size, 10½ lb. and 11 lb. being no unusual weight for cocks, the hens going to 8 lb. or more. As table fowls they are really excellent in

every particular, but like all other breeds that excel in this quality are not prolific layers. Of the many varieties we have, perhaps there is none better fitted to breed pure for either local or export trade. The chickens, like all Game, are always in killing condition, and at sixteen to twenty weeks are well suited for either the Sydney or London markets. Colonial Game I consider in every way fitted to supply the market with table poultry, and this can be done either by breeding pure, by crossing with other varieties, or by using them to improve the ordinary farm-yard poultry of the Colony. Any of the various colours will do, preference being given to the pure blacks, they being more, as the cockers left them, short-necked, short-limbed, wide-shouldered, big-bodied birds, and of great hardiness."

Chapter XXXII.

THE MEDITERRANEAN BREEDS.

It is now a great number of years since the Mediterranean breeds were introduced to Australia, and, excepting the Spanish, they have ever been and continue plentiful and popular. The shows, both in city and country, whenever and wherever held, can always be depended on to have a good display, particularly of Leghorns and Minorcas; while for the poultry-farmer, whose principal object is eggs, the two varieties mentioned are the most largely kept. Indeed, while a flock of three, four, or five hundred Orpingtons or Wyandottes are rarely if ever seen, it is nothing unusual to witness such numbers of Minorcas or Leghorns, and of the latter, particularly Whites. All the Mediterranean breeds are good layers, still, as with other sorts, when they came to be genuinely tested at the laying competitions, some of them performed but moderately, while others have not only occupied premier positions, but made records as well. At the Dookie (Victoria) College competition, which terminated last year, the winning pen was White Leghorns, these making, up to that time, the highest record at any test by any breed. The six hens laid 1,313 eggs, just on 219 eggs for each hen. The pen which finished next was also of the Mediterranean breed, the prolific Minorca, the six hens producing 1,228 eggs, or slightly under 205 for each fowl. The fourth prize were again Minorcas, with 202 for each hen; the fifth and sixth places were also occupied by Leghorns; the ninth pen were Andalusians, the six birds producing 1,159 eggs for the year, a number which would have won at some of the other laying tests. However, there is little need to bring evidence as above relative to the laying of the non-sitting breeds, all poultrymen being aware of their prolificacy. Still, as with all other fowls, there are poor performing strains, and at the test mentioned one lot of Brown Leghorns occupied the lowest place with 636 eggs, or 106 for each hen. However, an effective set-off in favour of the breed as a whole is the fact that of all the Leghorns competing, except the above lot, none laid less than 173 eggs each, a record unapproached by any other breed. Coming to the present Hawkesbury College competition, ten months of which have expired at time of writing, a pen of White Leghorns have laid 1,239 eggs, being 206·3 for each hen, a number

almost equal to the best twelve months' performance, and which by the end of the test will no doubt establish that pen at least as the best egg-producers in Australia. Nor is the good laying confined to this lot, another pen having laid 1,077, and another one reaching over the thousand in the ten months. These, of course, are the highest numbers made in the above time, the lowest being 574; and, as showing that the egg production is governed in America by strain, as well as here, one pen of Rose-comb Brown Leghorns have laid 1,027, and another lot 740, from the 1st of April to the end of January. Coming to the Rockdale competition, the ten months' laying is still better, for while Orpingtons are at top, the second place is filled by White Leghorns, with a record for the above period. The six hens produced 1,245, or 207·3 for each hen. As table fowls, Leghorns do not appeal to those who make this branch a feature of the industry. At the same time, poultry farmers who breed largely for eggs, in order to get laying pullets, must of necessity hatch and rear a similar number of cockerels, and these, of course, have to go to the market as table poultry, with the result that any sale day hundreds of these Leghorn cockerels appear there, and, as can be expected, being small and deficient in breast-meat, do not realise the best prices. Of late years, White Leghorns are being bred to a much greater size than formerly, and whether this has injuriously affected the egg yield is a debatable question. The effect is readily seen in the Sydney sale-rooms, the cockerels of this breed being of much larger growth than obtained a dozen years ago.

Poultry-farmers and others will recollect how at some of the early laying tests American Leghorns became much talked about. They were of small size, had rose combs, and are moderately plentiful in some of the American States. To the staid or permanent poultry-breeder, the undue notice these birds got was as perplexing as unmerited. For the first few months they certainly laid well, but anyone with even a brief knowledge of fowls would never think of drawing laying comparisons from a three or four months' trial. However, the American birds got talked and written about, and before any definite results could be obtained here the country of their origination was exploited for laying strains, and within twelve months a number of these small American fowls reached here, and their reputed merits heralded throughout Australia. However, as is well known, three pens of American birds competed in the 1903 Hawkesbury test, with the result that the wonderful Hansel birds, the great American layers, finished, not on the top, as some had hoped, but in fifth place, the actual laying being 200·2 for each hen, being beaten by four pens of Australian-bred fowls, the winning Wyandottes laying 218, followed by Black Orpingtons, 212·2; third place was filled by Andalusians, which laid 207, and the fourth by Leghorns, with 204·1. The eggs of the American birds weighed but 24 oz. to the dozen, while the Orpingtons, Andalusians, and Leghorns, which beat them in quantity, also scored heavily in weight, running from 25 oz. up to 27 oz. a dozen. Even a pen of the now despised Langshan fowls laid within eight eggs of the American Leghorns, the eggs here, again, weighing 26½ oz. to the dozen. However, despite this, expensive importations continued from America.

Poultry-breeders anxiously awaited the result of the 1904–5 test, where seven pens of American birds competed, and here, again, the Australians beat them hollow, the American fowls finishing third, ninth, sixteenth, eighteenth, eightieth, eighty-sixth, and ninety-third in the hundred pens competing. The best record of the American birds was made by Rose-comb Leghorns, which was 193·3 eggs for each hen, weighing 23½ oz. to the dozen, Mrs. Hansel's, this time, only making 1,071 for the six birds, while the great H. Van Dresser's pen of White Leghorns were away down with 750, or 125 for each hen; in this instance, however, the eggs were 27½ oz. to the dozen. The above reference is not purposed to depreciate the American birds as layers, for, although not winning any of the tests, they occupied, as a whole, good positions, but rather to show that, while not doing any better or even so well as our own in laying, these American Leghorns have affected the breed here for ill in table qualities; for although, as previously stated, Leghorns are not bred for table poultry, yet the half of those reared have to be marketed for that purpose. These American Leghorns, both Whites and Browns, were of very small size. This was not only apparent in the importations which have been exhibited, but in the competing pens as well. In the College Expert's report he mentioned that the Hansel Leghorns weighed but 3¼ lb. on arrival, but in two months after they got up to 3⅜ lb. each. Our own, or rather English Leghorns, go up to 5 lb. or even 5½ lb., and although some deprecate this great size, the Leghorn standard says "Large to be preferred, consistent with type." As I have shown, these American Leghorns for table purposes are of little account is now being realised in the proper quarter. The secretary of the Poultry Farmers' Co-operative Society lately called attention to this matter in the Press; but, more important still, in the country from where these small birds came, there is an agitation for greater size. Mr. J. K. Felch, a veteran poultry breeder, judge, and journalist, and holding a position in the American poultry world such as did the late Lewis Wright in England, in December last contributed the following to the American poultry Press. "The feed that makes muscle makes eggs. To use a dwarf because of prime colour is not good common sense in the poultry-yard. If by careful breeding we should raise the weight of White Leghorns to 5 lb. for pullets, 6 lb. for hens, 6½ lb. for cockerels, and 7½ lb. for cocks, they would become the most popular breed. This can be done and still preserve all the character and beauty of the breed. Take them off their Bantam legs, and raise them to a point of weight to make the males appreciated as early poultry meat, and make the breed far more popular and profitable."

It now having been shown that the large Leghorns lay as well or better than the small ones, and that as table fowls they are ever so much better, it follows that when new blood is wanted for either purpose—eggs or meat—we will, as heretofore, go to the world's breeding ground—England—for them, and no people on earth realise this to a greater extent than the cute Americans, who are the best customers English poultry-fanciers have, indeed for every fowl we import from England the Americans receive hundreds from the same

country, and one or two of the Americans from whom the Australians imported are the largest English buyers, and publicly announce such in the poultry Press of their country. Fortunately the breeders here are beginning to realise that everything good appertaining to fowls need not be American, and to the writer's knowledge there have been some serious disappointments in the expected egg-production of these importations, the effect of such being that within the past twelve months there has been almost a cessation of these American poultry arrivals.

I have mentioned England as the world's breeding ground; the following extract from an article in the *World's Work*, entitled "Where Great Britain is Supreme," will be opportune. "Curiously enough there are a few elemental facts which have remained unchanged and undisturbed, and will remain so, through every legislative reform, and every proposal for tinkering with tariffs. One of them has a vital bearing upon agricultural problems, and it is the comforting truth that the British Islands have hitherto formed a great depôt for typical breeds of stock, in every market of the world. One instance of the creation of such a type stands out in the development of the English thoroughbred racehorse. In other forms of horses, in oxen, in sheep, in dogs, in poultry, this country has gradually produced the types which remain unbeaten by the utmost energy of the rest of the world, and this, although it is mainly private enterprise on our part against the State-aided and bounty-fed competition of our neighbours and rivals. But nothing would have availed us were it not for certain underlying natural advantages which we possess in the climate, the soil, and the geological formations of our island home. Short of a volcanic cataclysm, these advantages we shall retain. There are in fact more varieties in underlying soil and rocks in the United Kingdom than in any other thickly inhabitated area of the same size, and this is the key to the problem of breeding."

Reverting to the other colours of Leghorns—Buffs, Blacks, Duckwing, and Mottled (Anconas), all are good layers, the small size being a handicap to their recommendation as a farmers' fowl. Minorcas have made great laying in several of the tests in this and other States, and although there is no good laying strain of the breed at the present Hawkesbury test, at Rockdale one lot of six hens laid 201 eggs each in the ten months, and any one who wants, above all other things, eggs, will not be disappointed in Minorcas. As table fowls they are not the best, still on the breaking up of one or two poultry farms this year, several hundreds of this breed were purchased for export, as boiling fowls, and when killed and dressed were attractive in appearance, big, fat, and white in skin. Andalusians are excellent layers of large white eggs. They were third at the 1903–4 Hawkesbury test, and made conclusive records at other competitions, and although not so plentifully bred as either Leghorns or Minorcas, those who patronise them would not give them up in favour of any other breed or variety of fowls. Spanish complete the Mediterranean breeds, this one-time useful fowl being now almost out of existence, and not likely to be resuscitated for any purpose.

(To be continued.)

Report of the Superintendent of the Cold Storage and Export Branch.

H. V. JACKSON,
Department of Agriculture.

The following are particulars of the operations at the Cold Stores during the year 1905 :—

RECEIPTS.—Poultry, Rabbits, Hares, and Eggs.

Month.	Fowls.	Ducks.	Geese.	Turkeys.	Rabbits in Fur.	Rabbits, Skinned.	Hares.	Eggs.	Poultry.	Cheese.	Milk.
					pairs.	single.		cases.	crates.	crates.	cases.
January	.	.	..	22	972	.	...	18	19	9	59
February	612	1,078	63	.	14,496	..	..	45	18	11	89
March ..	1,889	261	41	12	16,344		.	.	29	6	141
April .. .	634	64	..	202	44,232	1,440	60	...	52	32	96
May	30	106	..	576	187,236	4,500	9,276	...	70	6	199
June... . ..	1,467	..	30	168	296,796	1,950	25,644	.	40	15	320
July	370	..	96	623	333,672	750	24,816	...	19	..	234
August	120	...	12	233	356,412	...	20,592		55	5	216
September ..		.	12	797	178,644		5,664	5,077	8	4	268
October	861	1,187	107	615	27,168	.	300	2,654	4	10	222
November ..	3,168	835	31	80	....	...	...	166	9	.	190
December .. .	1,075	46	32	61	.	..	.	58	58	18	234
Total	10,226	3,577	424	3,389	1,455,972	8,640	86,352	8,018	381	116	2,218

DELIVERIES.—Poultry, Rabbits, Hares, and Eggs.

Month.	Fowls.	Ducks.	Geese.	Turkeys.	Rabbits in Fur.	Rabbits Skinned	Hares.	Eggs.	Poultry.	Cheese.	Milk
					pairs	single.		cases.	crates.	crates.	cases.
January . ..		.	.	57	12		.	261	7	2	44
February	270	776	45	26	8,664		96	148	18	..	113
March	1,798	352	59		756		24	1,208	28	.	112
April ..	1,050	69		108	17,400			2,025	26	21	56
May .	228	..		302	77,184		204	2,285	29	11	230
June . .	1,353	...	30	299	207,900	6,090	8,436	538	20	6	148
July		.	462	56	347,292	2,310	18,588	15	8	4	277
August	535	82	108	567	467,184		34,272	12	23	4	286
September...	72	108	12	986	201,720	210	14,688	10	55	4	183
October .		1,179	42	762	127,836	.	10,116	5	50	2	228
November	345	432	..	128	228	30	.	68	43	2	255
December	2,304	262	92	147				403	78	14	257
Total	7,955	3,310	850	3,438	1,456,176	8,610	86,424	7,278	385	70	2,189

The following figures show the total quantities received in previous years :—

Rabbits and Hares.

1901 ...	Rabbits (pairs) ..	80,351	Hares (single) ...	124,666
1902 ...	,, ...	113,125	,, ...	64,448
1903 ...	,, ...	640,541	,, ...	42,796
1904 ...	,, ...	915,999	,, ...	53,616
1905 ...	,, ...	1,460,292	,, ...	86,352

The total quantity of rabbits and hares packed at the Government Stores in 1905 were 1,503,468 pairs; and as 3,202,109 pairs of rabbits and

hares were exported from the State, it is apparent that some 1,698,641 were packed at the works of various freezing companies. The total number of single rabbits and hares treated therefore was 6,404,218 head, valued at £92,853. The rabbit and hare skins exported were 2,587,668 lb., valued at £93,472. The total value of rabbit and hare carcases and skins exported being £186,325.

Poultry (Head)—Packed for Export, at Government Cold Stores.

1898...	Poultry...	16,753	1902...	Poultry...	120,161
1899...	,,	22,808	1903..	,,	4,487
1900...	,,	44,505	1904...	,,	3,928
1901...	,,	73,140	1905...	,,	17,616

There appears to be a very satisfactory steady increase in the quantity of poultry exported during the year, and if birds of sufficient quality were more plentiful at exportable prices, the quantity could be very considerably increased. The orders offering are mostly for South Africa and for some Eastern ports. An idea of how very fine prices have to be cut by exporting firms may be gathered from the following extract from a letter from a South African firm:—"Fowls are known in the trade as 'Boilers' (3½ lb. minimum). Prices ruling are from 4s. 6d. to 4s. 10d. per pair, c.i.f., South African port." As to the export of poultry to the United Kingdom it has been practically nil, and the following list of prices, quoted by a London poultry trade journal, as recently as 16th December, will give poultry dealers here some idea of what little margin there is for any possibility of satisfactory business, when we consider the local value here of good poultry.

Turkeys (English, cocks)	each	9/-	18/-	Ducks (Irish)	each	1/8	2/6
,, (,, hens)	,,	5/-	8/-	Chickens (Sussex) ...	,,	2/6	3/3
,, (Irish, cocks)	,,	7/-	15/-	,, (West of England)	,,	2/-	2/3
,, (,, hens)...	,,	4/6	6/6	,, (Norfolk & Suffolk)	,,	1/9	2/3
,, (French, cocks)	lb.	-/8	-/10	,, (Boston) ...	,,	2/-	3/-
,, (,, hens)	,,	-/7½	-/8½	,, (Irish) ...	,,	1/6	2/6
,, (Italian, cocks)	,,	-/7	-/8	Capons	,,	4/-	5/6
,, (,, hens)	each	2/9	3/9	Pheasants	,,	1/9	2/6
,, (Austrian, cocks)	lb.	-/6	-/7½	Blackgame (Scotch) ...	,,	1/3	2/3
,, (,, hens)	each	3/-	4/-	Partridges (young) ...	,,	2/-	2/3
Geese (English)... ...	,,	5/-	6/-	,, (old) ...	,,	-/11	
,, (Irish)	,,	4/-	6/-	Fowls (old)	,,	1/6	1/9
,, (French)	lb.	-/6	-/6½	,, (live)	,,	1/-	1/8
,, (Italian)	,,	-/5		Wild Ducks	,,	1/9	2/3
,, (Austrian) ...	,,	-/5		Pintail	,,	1/-	1/3
Ducks (Aylesbury) ...	each	2/3	3/3	Teal	,,	-/10	
,, (Country) ...	,,	2/-	3/-	Snipe	,,	-/6	1/3

It will be seen from the above that the very highest price for best turkeys previous to Christmas was 18s., and down to 9s. each; hens, 5s. to 8s.; all much lower than in Sydney. While, by the pound weight, French turkeys were 7½d. to 8d., Sydney rates at the same date being 1s. 3d. to 1s. 6d. per lb. retail.

Below will be found the quotation in Dublin. This market is but a few hours from London, and what chance, therefore, at present, has Australia of competing with chickens and ducks 1s. 4d. to 1s. 8d., and turkey cocks (prime) 8s. to 10s. each.

"Dublin, 13th December.—There has been an active demand for best chickens and hen turkeys; geese are difficult to move owing to mild weather, otherwise large supplies have cleared well. Game and wild fowl are offering with fair seasonable quantity, and clear at moderate prices.

Chickens	each	1/-	2/4	Widgeon	each	-/6	-/10
Hens	,,	1/-	1/6	Teal	,,	-/6	-/8
Ducks	,,	1/4	1/8	Woodcock	,,	1/6	2/-
,, fat	,,	2/-	2/4	Snipe	,,	-/6	-/10
Turkeys, cocks... ...	,,	4/-	6/-	Plover, golden	,,	-/8	-/10
,, ,, prime ...	,,	8/-	10/-	,, green	,,	-/5	-/6
,, hens	,,	3/6	4/-	Grouse	,,	1/9	2/-
,, ,, prime ...	,,	5/-	6/-	Partridges	,,	1/6	2/-
Geese, dead	,,	2/6	3/6	Pheasants	,,	1/6	2/6
,, fat	,,	4/-	4/6	Hares	,,	1/6	2/-
Wild Ducks	,,	1/-	1/6	Rabbits	doz.	3/-	7/-

A large number of people here, when the result of their produce sales locally fall short of expectations, immediately commence to talk about, and tell us of, the markets awaiting in London, giving little thought as to whether they are paying markets or not, and forgetting that the largest suppliers of poultry to South Africa come from England, while the following paragraph from a trade journal of December last shows that London is actually supplying the New York market with its Christmas game:—

"The American boat goes away this week with her refrigerator full for the New York Christmas market. This consists largely of plover, snipe, woodcocks, and wild fowl. The price of plover has been kept up for some weeks on account of the buying for these shipments."

The following report on the poultry trade of the year has been received from Mr. Bradshaw:—

"The quantity of poultry treated at the export depôt for the year, as shown, were about four times the quantity of the previous year, and consisted largely of boiling fowls for South Africa. Orders numbering four times the quantities treated were received by Sydney shippers, but the stipulated prices were so low that breeders here would not accept. New Zealand, Queensland, and Tasmania accepting at the lower rates. Consequent on our erratic seasons, poultry foods were at abnormal prices throughout the greater portion of the year, obliging the bulk of breeders to send to market thousands of half-grown poor conditioned chickens, which were disposed of at prices as low as 1s. a pair, and even when double that price was obtained the production of such entailed a loss. During a large portion of the year prime quality chickens were never in sufficient numbers to supply the demand, and when such were offered, 6s., 7s., and up to 8s. was received for them, clearly showing that Sydney offers a good payable market for prime quality goods.

"In the plentiful period of the year, some fair quality chickens were obtainable at moderate rates, and one trader purchased a quantity of these, got them prepared and frozen, with the object of testing the local market with frozen fowls at the dear period. The experiment was a success, the birds were sold prior to Christmas, and, after paying all charges, storing, &c., a clear profit of 2s. a couple was realised, thus showing that this branch of the industry has cold room possibilities akin to that of eggs.

"On several occasions throughout the year I have been consulted by prospective breeders about the possibilities of the English markets. I have always told these inquirers that I would rather see half a dozen fowls reared

and fit for the English market than to hear of the imaginative thousands. Hitherto Sydney has been able to absorb all the prime fowls offering, at good prices, and should the time arrive of over-production of these, the English markets are then available, but at certainly much lower rates than hitherto obtainable here; and whether the English prices be payable ones will be determined the present year by the contemplated shipment of a considerable quantity of chickens reared and fed with the twofold object of winning good prize money first, and then being sold in London by the best salesmen there, thus effectively determining the paying possibilities of an English export poultry business with Australia."

Eggs in Cold Storage.

There is a continued increase in the demand for space for egg storage, and the following are the quantities held in store during the past eight years:—

1898 ...	11,000 doz.	1901 ...	140,292 doz.	1904-5...	251,640 doz.
1899 ...	93,000 ,,	1902-3...	130,524 ,,	1905-6...	288,648 ,,
1900 ...	96,000 ,,	1903-4...	151,128 ,,		

The following were the average wholesale prices of eggs monthly:—

1905.	d.	1905.	d.	1905.	d.
January ...	8⅝ per doz.	May	16⅛ per doz.	September ...	6¾ per doz.
February ...	11¼ ,,	June	15⅞ ,,	October ...	6¾ ,,
March ...	12⅝ ,,	July	10¼ ,,	November ...	7½ ,,
April ...	14¼ ,,	August ...	7⅜ ,,	December ...	9¾ ,,

The storage of eggs fluctuates very much in ratio with the prices. In January and February, 18 and 45 cases were received, while in March, April, May, June, July and August, none were put into store, the season being practically closed; but, opening again on 1st September, 5,097 cases were received, followed by 2,654 cases in October, 166 in November, and 38 in December, or a total of 8,018 cases. The deliveries, however, were—in January, 261; February, 448; March, 1,208; April, 2,025; May, 2,285; June, 538; July, 15; August, 12; September, 10; October, 5; November, 68; December, 403; or a total of 7,278 cases. The receipts and deliveries, as shown above, afford a correct monthly index to the market value of the product of the hen, one season being almost a duplicate of its predecessor. On this subject, Mr. Bradshaw, the Poultry Expert, says:—

"The spring months of September and October are those wherein all poultry produce the greatest quantity of eggs, and, the markets then being at their lowest, farmers and others largely confine themselves to these months for storing; and, although with but the one object of holding over till a dearer period, this has the additional effect of relieving the overstocked markets in the months mentioned. Indeed, had cold storage not been available during the past season, and the above 288,000 dozen left on the local market, the result would have been disastrous to the producers. Again, just as certain spring months in the year are the cheapest, and those wherein the greatest storage is done, in the same way two or three of the early winter months, particularly April and May, are the dearest for this product, and those wherein the largest deliveries take place. At the same time, once February arrives a distinct rise takes place, and from this on deliveries are made in increasing numbers till the months mentioned, June generally witnessing a clearance. This gradual and lengthened delivery, as opposed to the brief season of receiving, has the wholesome effect of the market never being overstocked with the Cold Store eggs to an extent of affecting the price of the current arrivals during the dear period of the year."

The value of the produce handled at the Government Cold Stores, and delivered on account of customers, is estimated at £80,856 10s. 9d., as shown hereunder :—

		£	s.	d.
1,456,176 pairs rabbits	...	54,651	12	0
8,460 ,, ,, (skinned)		105	12	6
86,424 ,, hares	...	3,781	1	0
7,955 ,, fowls	..	894	18	9
3,310 ,, ducks	...	372	7	6
850 ,, geese	...	191	5	0
3,438 ,, turkeys	..	1,031	8	0
7,278 cases eggs	...	15,283	16	0
2,189 ,, milk	...	3,283	10	0
385 crates poultry	..	1,155	0	0
70 cwt. cheese	..	70	0	0
91 bags peas	..	36	0	0
		£80,856	10	9

The work of the Government Cold Stores has been carried out satisfactorily, and every praise is due to the manner in which Mr. Higgs, the Storekeeper, and Mr. Bradshaw, the Inspector, carried out their respective duties.

Owing to the large quantity of goods in the Government Stores, and the approach of the summer season, when the Department usually closes down on the rabbit-packing, the operations at the depôt as regards rabbits and hares gradually came to an end early in September. Some, exporters continued packing at various freezing works in the country and in Sydney, arrangements having been made, in most instances, for the services of Government graders.

The trade of the State has shown very considerable expansion, and the principal articles exported oversea during twelve months, January to December, were as follows :—

		Australian Produce	Total	£	£
Animals—Horses	No.	5,460	5,461	125,576	126,076
Butter	lb.	19,975,065	19,975,125	816,064	816,607
Coal	ton	2,020,559	2,020,559	841,577	841,577
Copper	cwt.	379,095	379,095	1,258,380	1,258,380
Fruits—Fresh	cntl.	87,870	89,671	43,632	45,427
Gold—Coined, Uncoined ..			...	2,211,436	2,578,415
Grain—Wheat	bshl.	4,313,603	4,313,603	727,985	727,985
Flour	ton	39,034	39,080	307,876	308,327
Lead	cwt.	958,763	958,763	584,829	584,829
Leather		..	...	223,265	227,179
Meats—Beef...	lb.	2,089,776	2,089,776	22,752	22,752
Mutton and Lamb	,,	51,532,949	51,532,949	545,415	545,415
Rabbits and Hares	pairs	3,202,109	3,202,109	92,853	92,853
Meat—Preserved	lb.	7,331,897	7,346,417	154,712	155,118
Oil—Cocoanut	ton.	5,298	5,298	127,512	127,512
Ores		... ...	... ..	519,204	519,662
Silver Bullion	oz.	823,452	831,587	95,574	96,524
Silver-lead Bullion ...	cwt.	607,978	607,978	559,120	559,120
Skins—Hides	No.	153,458	153,458	158,479	158,479
Sheep	,,	3,291,516	3,291,516	410,915	410,915
Rabbit and Hare	lb.	2,587,668	2,590,101	93,472	93,905
Other			......	270,620	270,620
Tallow	cwt.	370,581	370,581	442,331	442,331
Timber		.. ..	.. ...	320,740	331,127
Tin	cwt.	58,818	58,818	413,664	413,664
Wine ...	gal.	24,538	31,301	7,309	12,340
Wool	lb.	230,433,952	230,433,952	11,141,335	11,141,335
Other articles		...	...	766,991	1,573,413
Total	£		......	23,284,158	24,481,887

NOTE.—The difference between the value of Australian produce exported and the total export represents the value of produce of oversea origin re-exported.

Through the courtesy of Mr. N. Lockyer, Collector of Customs, Sydney, I am able to append some particulars of exports to the United Kingdom, South Africa, Hong Kong, Japan, and the Philippine Islands.

D

EXPORT of the Products of New South Wales from the Port

Months.	Butter.		Wheat.		Flour.		Leather.	Beef.	
									UNITED
	lb.	£	bushels.	£	cental	£	£	lb.	£
January	1,786,008	74,417	805,005	134,167	200	85	7,644		...
February	309,288	12,°87	1,394,008	232,333	22,478	9,551	6,347		
March	471,800	19,658	565,133	94,189	17,279	7,271	11,720		
April	157,3?0	5,901	160,752	26,121	42,772	17,282	36,064		
May	1,018,920	38,210	315,829	51,321	35,015	13,263	6,544		
June	495,483	19,613	70,844	11,803	31,620	12,121	7,808		
July	1,046,584	44,698			18,906	7,230	20,988		
August	1,035,832	45,317			12,785	4,832	25,652		
September	1,382,752	60,495			4,350	1,495	14,157	163,508	1,703
October	1,274,772	55,757	31,999	5,560	226	90	14,586	49,382	412
November	2,142,896	93,751	90,809	16,776	8,262	3,332	42,296	18,919	160
December	2,093,000	91,849	186,924	31,933			36,516	88,882	741
Total	13,214,700	562,553	3,621,303	604,206	193,858	76,552	230,322	320,691	3,016
									SOUTH
January	18,260	619			1,081	586	1,916	31,622	481
February	28,944	1,267			34,223	13,190	1,260		..
March	45,194	1,981	24	4	10,260	4,516	3,540	40,477	707
April	31,050	1,455			2,027	867	3,428	16,640	246
May	112,550	5,080	53	13	34,326	13,431	5,173	64,114	103
June	88,250	4,000			9,768	3,867	4,353	17,064	301
July	45,700	2,035					4,759	13,195	205
August	58,050	2,718			200	79	2,456	49,451	766
September	2,700	135			578	230	5,823	22,117	310
October							2,354	79,069	772
November	63,140	3,137	25,076	4,701			3,883	497,219	5,812
December	107,800	5,201			1,320	585	2,841	288,901	3,662
Total	601,638	27,628	25,153	4,718	93,783	37,351	41,786	1,119,949	13,365
									HONG
January	9,730	401			150	64			
February	7,922	327			250	110	969		
March	8,448	360							
April	30,556	975			250	100			
May	6,960	297			6,840	2,520			
June	16,034	641			2,144	808			
July	3,240	157			12,762	4,814			
August	910	45			17,789	6,922	129	7,396	105
September	8,084	396			21,515	8,606	1,564		
October	8,188	413			22,110	8,753	552	9,291	134
November	7,980	360			38,823	11,564		14,178	203
December	24,512	1,158			17,393	6,806		5,254	86
Total	132,564	5,530			140,026	51,157	3,214	36,119	530
									JAPAN.
January	2,460	113	27,846	4,824	40	16	2,769		
February	1,000	47	43,517	7,434	500	211	1,726		
March	2,488	104	18,666	3,186	910	368	1,783		
April	500	25	212,355	34,417	700	278	8,712		
May	1,500	75	56,113	9,867	6,247	2,243	15,260		
June	884	36	590	96	1,048	357	2,736		
July	448	19			400	154	544		
August					500	194	1,734		
September	598	25			5,643	2,241	912		
October	540	21			3,395	1,448	1,357		
November	784	38			990	389	885		
December	4,412	204			1,500	625	646		
Total	15,614	707	359,087	59,824	21,873	8,524	39,064		... ..
									PHILIPPINE
January	18,232	719		...	500	219	.. ...	34,469	455
February					800	367		. ...	.. ..
March	18,948	796			340	138			
April		...			1,675	685		22,009	287
May	15,460	708			1,046	401	109	....	......
June	46,906	1,895			4,380	1,710			....
July	22,408	961			5,418	2,154	16	11,970	155
August				...	3,060	1,172	...	9,227	120
September	56	2			4,046	1,625	...	6,009	75
October					4,100	1,639		....	..
November	23,524	1,099		...	6,170	2,523		1,072	13
December	45,000	243			800	330		223,612	2,143
Total	190,534	6,423			32,335	12,963	125	308,368	3,248

of Sydney during the year ended 31st December, 1905.

Mutton and Lamb.		Rabbits.		Preserved Meat.		Timber Undressed.		Months.
KINGDOM.								
lb.	£	pairs	£	lb	£	sup. ft.	£	
753,307	10,344	33,390	1,379	367,408	6,123	106,696	668	January.
554,204	7,402	66,298	2,656	116,648	1,944	93,636	563	February.
163,542	1,779	118,278	3,899	42,920	716	100,558	640	March.
143,286	1,493	55,752	2,339	1,302	23	16,258	92	April.
23,320	385	85,929	3,484	165,630	2,760	48,427	282	May.
		285,492	11,413	76,029	1,267	69,512	389	June.
683,116	5,875	666,696	33,156	423,170	7,475	73,630	330	July.
945,097	11,213	347,036	16,591	435,548	7,605	51,556	398	August.
5,056,537	57,256	561,579	26,652	485,888	8,098	107,183	603	September.
8,604,048	114,399	374,653	17,397	926,000	19,928	286,325	1,576	October
5,817,996	66,831	290,[illegible]87	13,010	219,044	3,651	136,664	1,354	November.
6,778,191	74,627	143,561	6,799	874,008	16,233	217,106	1,207	December.
29,522,644	351,804	3,029,051	138,775	4,233,685	75,823	1,307,551	8,102	Total.
AFRICA.								
36,355	566	..	.	18,960	384	555,607	2,467	January.
20,350	281	2,400	124	1,900	22	40,666	347	February.
977,572	14,125	4,437	223	59,179	1,146	1,362,30[illegible]	6,221	March.
367,075	5,217	3,264	151	21,840	469	358,639	2,761	April.
185,749	6,736	14,550	566	20,753	392	194,351	1,639	May.
569,245	7,511	12,174	465	8,160	243	1,022,189	7,664	June.
597,378	7,527	9,540	69	18,096	370	319,668	2,380	July.
1,696,049	20,892	20,736	814			308,311	3,095	August
1,497,558	16,530	15,276	599	10,800	222	168,947	1,448	September.
1,064,759	11,082	6,624	238			1,800	19	October.
1,847,637	21,249	5,820	228	8,045	180	441,637	4,081	November
2,087,556	21,953	6,012	258	12,000	249	186,317	2,037	December
11,247,283	133,669	100,633	4,035	179,733	3,677	4,969,440	34,159	Total.
KONG.								
126,723	1,376	1,248	57	6,380	108			January.
306	5							February
608	15			3,744	39			March.
5,723	88	504	16					April.
1,995	14			1,800	33	2,567	34	May.
2,035	43	32	3					June.
2,072	44							July
2,022	43							August
5,246	84	108	9	47,160	892			September.
9,298	119	108	7	60	6			October.
43,827	524	370	21	48	2	559	4	November.
68,578	663	654	42					December
268,433	3,048	3,024	155	59,492	1,080	3,126	38	Total
				100	3	9,240	78	January
				1,056	12	.	... ..	Feb.
						1,225	7	March
						150	1	April
				108	5			May.
								June
								July.
						1,050	10	August
						1,724	21	September.
				336	8			October.
..		60	3	96	3		. ..	November.
2,015	24							December.
2,015	24	60	3	1,696	31	13,389	117	Total.
ISLANDS.								
36,412	508	396	14		..	76,354	566	January.
... .						37,645	305	February.
3,175	50	156	8			53,410	339	March.
.. ..		612	28			5,484	45	April.
10,348	151	448	18			138	1	May.
. ..		24	1			. . ..	.. ...	June.
38,869	509	6,744	279					July.
14,193	204	1,200	47		...	457,852	3,662	August
85,344	863	664	53		.. .	239,938	1,914	September
13,648	121							October.
63,782	650	636	37	..			.. .	November.
89,263	875	1,764	90					December.
355,034	3,931	12,644	570	...	.....	870,821	6,832	Total.

Honey.

ALBERT GALE.

ABOUT the close of the old year the Acting Agent-General for New South Wales sent a report out concerning the British market for Australian honey, and that report was anything but complimentary to the Australian product.

That Australian honey in England is not relished as an article of diet is well known to the Australian producer. Such knowledge has been in his possession for the last ten to fifteen years, and frequent efforts have been made to nullify what was once believed to be the "English prejudice against this Australian product." The Home belief was that our honey was the most inferior article of its kind that was sent to the English market. The pros and cons of Australian honey is still a contentious theme between these two parties.

There is no doubt that the senses of mankind can be highly educated to like or dislike the various objects presented to them. Things that once were hated, may, by education, become things that are dearly attractive. This is more particularly observable as it regards the organ of taste. Some foods that have, from time to time, been introduced from barbarous, or semi-civilised, people to our more refined taste, although not in themselves deleterious, nay, may be highly nutritious, are far from acceptable. There is no doubt that there are people now living who can well remember when the rhubarb plant was first introduced to the London public. It took years to overcome the prejudice formed against it. Now, I suppose, there is not a kitchen garden where the plant is not grown, nor a table where this once despised substitute for fruit is not to be met with, especially in the early spring.

There is no denying the fact that a deeply-rooted antipathy towards Australian honey exists in the old land, caused no doubt by the inferior grades of the article shipped Home. At one time there were only two classes of honey known here, "bush" honey and "garden" honey, and this latter was only one or two removes from the former. The difference consisted, not so much in quality or degree, but in the quantity of foreign matter mixed with bush honey, it being far in excess of that contained in the so-called garden honey. "Bush" honey was obtained from trees felled in the bush, and "garden" honey from hives of any description. "A burnt dog dreads the fire." So Londoners and others, having once tasted the inferior article sent Home, have come to the conclusion that all our honey is of the same mixed character. Nevertheless there are grounds existing for a dislike to some of our honeys. The honey produced from some of our native flora can never be improved. Bees have no power over the article they gather and store, neither has the variety of bee anything to do with it. No matter be they the high-classed Italians or the old-fashioned black bees, the article they

bring home is one and the same. The hollow tree, box-hive, or bar-frame in no way affects the flavour of the honey obtained from the nectar of the flower. The honey extracted from the combs of the bar-framed hive is undoubtedly far more marketable than in either of the other bee-homes on account of the absence of the foreign matter therein contained.

We are told the chief characteristics in honey suitable for the British market are flavour, colour, and clearness. The best honey should be sweet and clean in flavour. By "clean in flavour" I suppose is a honey that leaves no twang in the mouth after being eaten. In appearance a "pale set clear"—*i.e.*, a honey that is something of a water-white—and this is the honey that takes first place as regards colour. Amber honey takes second place, and brown honey must take a back seat altogether. Honey having these grades in colour we have in New South Wales. Be it noted the most important characteristic in honey is its flavour Some of the pittosporum trees give us a honey that is "sweet and clean in flavour and pale set clear in appearance." But to get a sufficient quantity to supply both for local consumption and exportation will be an impossibility, as the trees are only in bloom for a short period during spring-time. The pittosporum referred to is indigenous. I know that many of our exotics that are now grown here produce a honey having all the characteristics that are so dear to the British public. If we can supply a honey of the required flavour and abovenamed appearance, then we shall have an equally good paying market here for it, nay, it would pay us better to keep it here. Amber honey is produced here in fairly large quantities. It is a product from our white and yellow box trees. Miles of these trees are to be met with on the western slope of the Great Dividing Range. The flowering of these trees is somewhat spasmodic. Some years the air is highly charged with the odour produced from the blooms of these trees, insomuch so I have known the inexperienced go in search of a bees' nest supposed to be in the locality. Good box honey finds a fairly ready market locally. The most plentiful honey we have is the "brown honey which is regarded as the most inferior." Most of our indigenous flora along the coastal district is of this class. In fact, some of this dark honey can be scarcely said to be brown but a treacle colour, and is not "sweet and clean in flavour," and is not even marketable where people are used to a honey that is not "clean in flavour."

The honey produced in every country is of various grades both in flavour and colour, and we may also add density. This mixture of tints and flavour is at once apparent when we remember the diversified character of the honey vegetation, and that every continent, country, and island is clothed with a vegetation peculiar to itself.

From the Acting Agent-General's report it seems only 20s. to 25s. per cwt. is given for honey of the finest grade, and the second quality, that of an amber tint, is as low as from 14s. to 18s. per cwt. We have no honey here that can be regarded as sufficiently "sweet and clean in flavour" that will meet the standard required at the hands of the British public. Of course, we often see at our shows small samples of this superior class of honey, but

it has never been produced in sufficient quantity to supply a local demand. In our orange-growing districts a honey is produced that will answer to every point in the grade required, but the quantity is extremely limited and the harvest of short duration. The same may be said of fruit-growing districts where fruits other than the orange are grown.

For table purposes the honey imported into Great Britain from California is the most sought after. This honey is obtained from a salvia locally known as mountain sage, and also from lucerne. The United States of America is noted for its light-coloured honeys. It is obtained from indigenous plants and alsike clover, but honey from this latter plant is obtained from where farmers or graziers have learned the value of alsike clover as a forage plant. Large quantities of nearly white honey are obtained from those regions that are devoted to raspberry-growing. The honey from cucumbers, where they are grown for pickling purposes, is also much sought after. Red clover produces a honey a little darker than the foregoing. We have therefore very little chance to obtain a footing in the London market with our honeys for table use until our rural population are seized with the idea of growing artificial forage plants. Along the coast districts white clover is making itself known to bee-keepers, and the same may be said of lucerne, but the latter is cut for hay just as it comes into flower.

When we consider the freight, commissions, &c., to be deducted from the 20s. to 25s. given for the first-class article, 14s. to 18s. for second-class, and Australian honey worth only 12s. per cwt., including all charges, there does not appear to be much left for the bee-keepers' labour and expenses. The Australian public are not honey eaters, and do not use it as a standard table delicacy. In private families, hotels, or restaurants it is seldom on the tables, and the reason is said to be that first-class honey is not obtainable at all times. I think there will be as good a market in Australia for a honey that is "sweet and clean in flavour and pale set clear in colour," as in England, and as good a price obtained for the same without the trouble and expense of exporting it. For our dark and somewhat strong-flavoured honeys, a market will have to be found here.

Hawkesbury Agricultural College and Experimental Farm.

Mowing and the Use of the Scythe.

HUGH REID,
Gardener, Hawkesbury Agricultural College.

The art of mowing is most readily acquired when young. It brings into play a special set of muscles in the body, and to those who start late in life the task is irksome and laborious. With the young man the voluntary muscles brought into constant action with the twisting motion of the body are supple and easily brought into use. Once the initial lessons are learned, the dexterous use of the scythe is never forgotten. Mowing should be a part of the training of every farmer. The scythe is constantly needed where live stock are reared, where crops and forage plants are grown, and where the home is rendered attractive by garden or lawn. There is probably no implement so constantly in requisition on a well-kept farm or orchard as the scythe. As with other agricultural implements, it is essential to keep it in good order with its appurtenances.

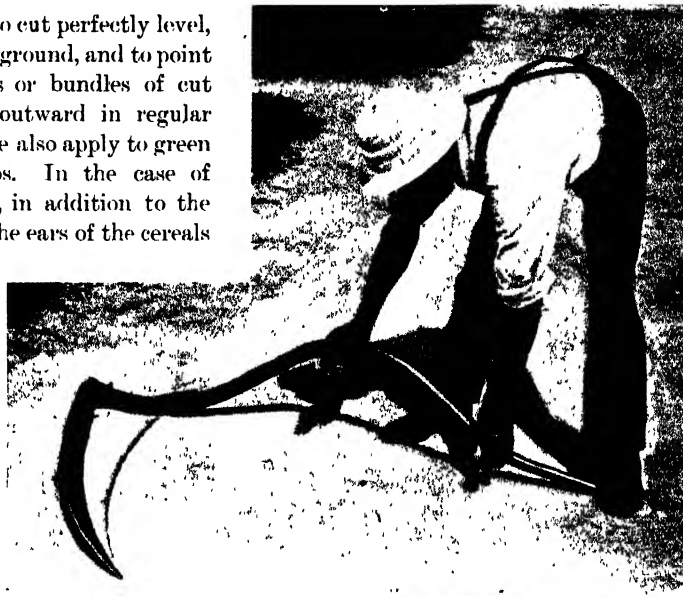
1.—The socket adjustment, to set the blade for a broad or narrow sward.

The character or style of scythe is determined by the nature of the ground on which the crops or grass are grown. For instance, a long and almost straight scythe may be used where the paddock or garden is level and unbroken, but where it is uneven and rough a short and somewhat curved scythe is most suitable. There are many forms of scythes; all have their special qualifications. One that may generally be adopted for all-round farm, garden, orchard, or station purposes is that known as B.Y., with the patented riveted or clink back and adjustable blade.

2.—To set the scythe for a very broad sward. The left-hand figure shows a scythe-blade heel as purchased; the right-hand one as bent for use.

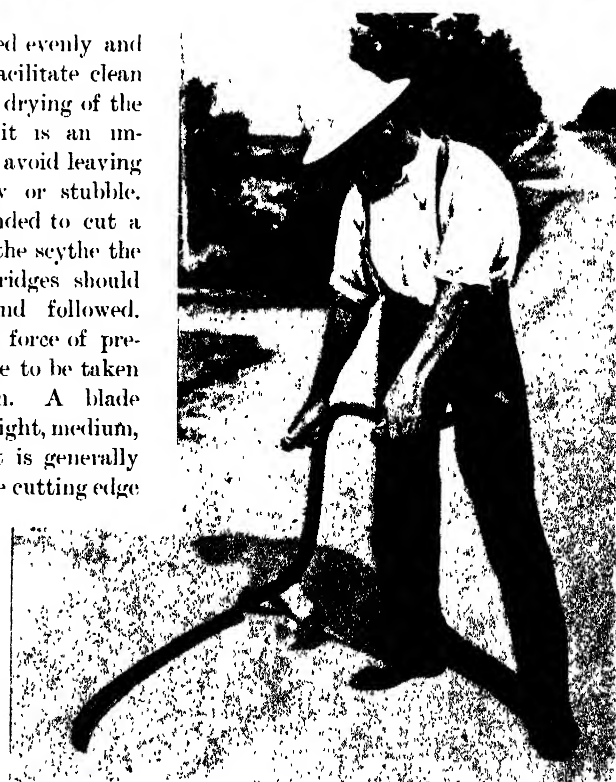
The points to observe in mowing are controlled by the undulating or level nature of the ground and the class of crop or grass. Where grass has to be cut

the aim is to cut perfectly level, close to the ground, and to point the swathes or bundles of cut grass well outward in regular order; these also apply to green forage crops. In the case of grain crops, in addition to the foregoing, the ears of the cereals



3.—To set the blade for a very wide sward.

should be collected evenly and laid in line, to facilitate clean sheafing and the drying of the crop. Further, it is an important feature to avoid leaving much loose straw or stubble. Where it is intended to cut a crop of grain by the scythe the direction of the ridges should be ascertained and followed. The direction and force of prevailing winds have to be taken into consideration. A blade may be set to cut a light, medium, or heavy crop. It is generally recognised that the cutting edge



4.—A low-set blade for short grass.

should be a little elevated above the ground and above the back of the blade which sweeps along the surface. The cutting edge is thus placed in an oblique position against the stems of the plant, and it severs it with greater certainty, acuteness, and freedom.

The illustrations are so arranged as to assist the amateur to grasp the principles associated with mowing.

A study of No. 1 exhibits the socket adjustment of the B.Y. scythe to enable the operator or mower to alter the sweep of the blade or the scope of its work, so that he can, by altering the adjustment, with this instrument, and with equal facility, cut a broad or narrow sward, ranging from 4 to 11 feet.

Where a scythe has to be set or adjusted to take a very broad sward, as in the case where very short grass on lawns has to be cut close or practically shaved, then the heel of the scythe blade can be heated in the blacksmith's forge, and set out or extended; this is shown in the illustration No. 2. It should be remembered that when the heel is thus set the blade cannot be used for cutting a heavy forage or grain crop.

5.—A medium-set blade for general mowing purposes.

Illustration No. 3 shows the setting of the blade for a very wide sward of about 11 feet. The mower's position is thus seen. He places the scythe on the ground with his foot against the handle, then with the point describes an arc of a circle, as shown in the illustration, then placing the scythe down flat, an estimate of the distance from this line to the heel of the scythe can be formed. For heavy crop the distance is as shown; the distance is decreased for light crops.

No. 4 illustrates the mower in a correct position to commence operations on the short grass of a lawn. The blade lies flat on the sward with heel and point in juxtaposition.

No. 5 is intended to illustrate a medium-set blade for general mowing purposes, disclosing the attitude of the mower when cutting long grass,

lucerne, barley, or oats. The sward of the average farm crop should be about 10 feet long, grass 8 feet.

6.—The teacher showing how to take a 11-ft. sward—entering the full swing.

In illustration No. 6 a demonstration is given of cutting a 11 feet sward of lucerne at the point of entering the crop. Both arms are outstretched fully with the swing to the right. The point of the scythe blade must be in a

7.—Finishing the full swing of a 11-ft. sward.

straight line with the heel of the right foot when the first movement is made, and on finishing the swing the blade is in line with the heel of the left foot.

The left hand kept on the handle must be opposite the left hip-joint and maintained firmly in this position during the progress of the blade in the

8.—A false sward. Bad position; only 4 ft. to 6 ft. wide.

swing round, until finished. This position should be rigidly maintained. To allow it to get lower or higher, the point of the blade gets out of line and

9. A mowing class of students. Taking a sward of 10 ft. 6 in.

sticks in the ground. It may result in snapping it. If the left hand be permitted to extend away from the body the blade will drag and fail to cut.

The illustration No. 7 gives a full view of the mower finishing the swing on a 11 feet sward, or completing the cut. Here we notice the handle of the scythe and its relationship to the body and heel of the mower. The mower's toe on the left foot is raised on entering the sward, and as the blade swings round the cut is finished with the toe raised on the right foot.

These positions are distinct and correct; but in No. 8 we have evidence of the false or awkward position of the mower, in which he cuts a false, poor, or chopping sward only 4 to 6 feet wide.

A class of students is at work in No. 9. The cut is an average of 10 ft. 6 in. of lucerne. The crop was 18 inches long. They worked from 7·30 to 11·30 a.m. and 1 to 5 p.m., and each student averaged 2½ acres per day after a week's practice with the scythe. An expert mower of mature age would cut from 4 to 4½ acres in the same time.

After securing the correct idea of setting a scythe blade to meet the needs of the ground and crop, it is important to note that the handles are placed in

10. Suitable positions in sharpening blades.

correct position to ensure a well-balanced movement. In each case the handle for the right hand should be so transfixed and adjusted that, when taken up on the index finger, it will balance and hang evenly. To keep the blade in true cutting order, a scythe stone is used, and it is in these operations of sharpening proper dexterity is essential. A sharp, fine-grained stone should be selected. To sharpen the blade place the point in the grass on the left-hand side, grasp the heel firmly with the palm of the left hand, and with the right work the scythe stone, which is about 14 inches long. Make sliding strokes downwards on each side alternately with the stone. Keep it flat on the blade and avoid turning the edge. The last stroke of the stone should always be on the side which hugs the sward. When using the stone slide the hand half way down the blade and rest the elbow against the blade to keep it rigid. The sliding strokes downwards acts on the edge of the blade and converts it into a series of minute teeth like a saw and provides a keen cutting edge. The sharpening operation commences at the heel and proceeds evenly downwards until the point is approached; when the blade has

to be raised and supported to sharpen the final few inches, the strokes are shorter and sharper with the stone. Care should be taken to effect sharpness on the point. Pass the thumb gently along the whole edge of the blade to ascertain if the edge be equally keen all through.

In No. 10 we see the operation in its various stages.

When mowing is finished, the careful man will always wipe the blade thoroughly dry, smear it freely over with vaseline, clean the handles, and hang it up in an implement shed or house. Often we notice good implements spoiled by hanging them up where the sun reaches them, warps the handles, rusts the blades, and takes the temper out of the steel.

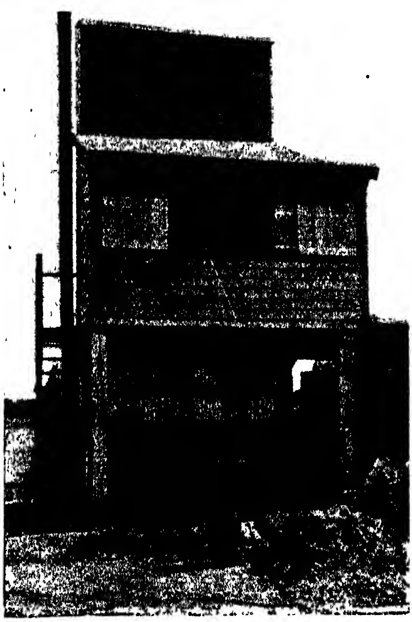
Reports from the Commercial Agents.

In the January issue of the *Agricultural Gazette* some mention was made of a report by Mr. Valder on the possibilities of trade with South Africa in broom millet. A further report has now been received from Mr. Valder, wherein he reports there is reason to believe some small orders as a trial will be sent from New South Wales, and he says: —"Broom-making is an industry which has only very lately been started here. From what I can ascertain, there is only one small factory here, the principal output of which is flat carpet brooms of the American type. The manager of this complains that his operations are greatly restricted by keen oversea competition; a large proportion of the imported brooms, brushes, and scrubbers being, he says, made by the cheapest labour in British and American convict prisons. He states, however, that if properly fostered, the industry is capable of considerable extension. At the present time. the great trouble being the high cost of broom millet, it is hoped that New South Wales millet will be somewhat cheaper than the American so far used. If New South Wales millet is good, and the price suitable, there is no reason why the industry in South Africa should not be greatly extended, which means that there is a good prospect of a considerable trade in this product with New South Wales."

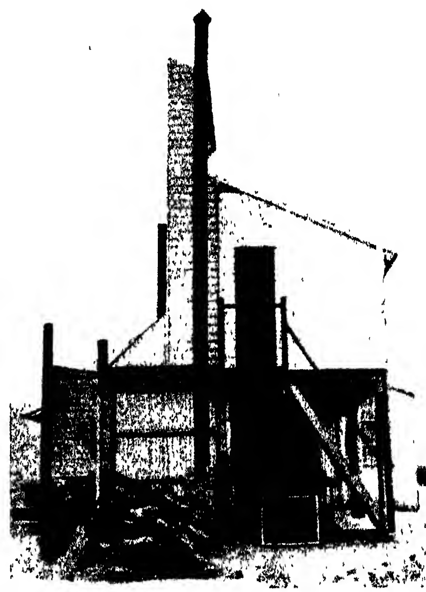
Fruit Evaporators.

F. G. CHOMLEY.

In districts where sun drying is impracticable, some artificial means of dealing with fruit becomes a necessity. Even in those districts where sun drying can generally be relied on, an evaporator for finishing-off partially sun-dried fruit, or for carrying out the entire drying in the event of unsuitable weather, is a



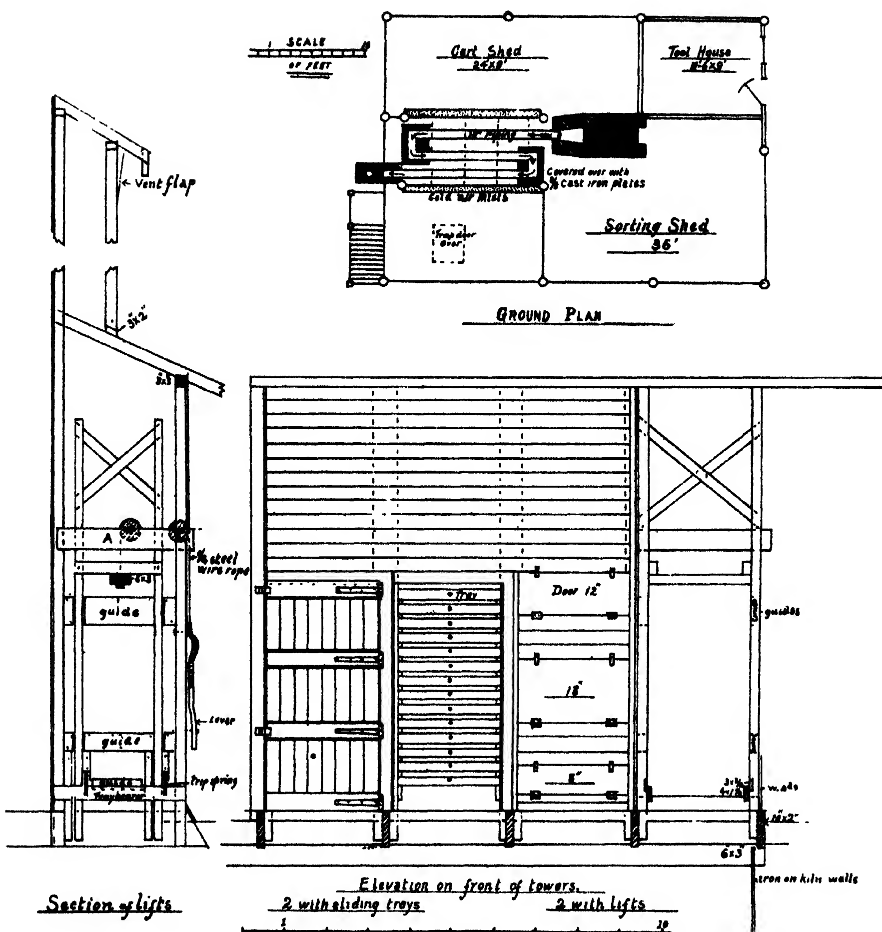
Side view of Evaporator in use at Hawkesbury Agricultural College Orchard.



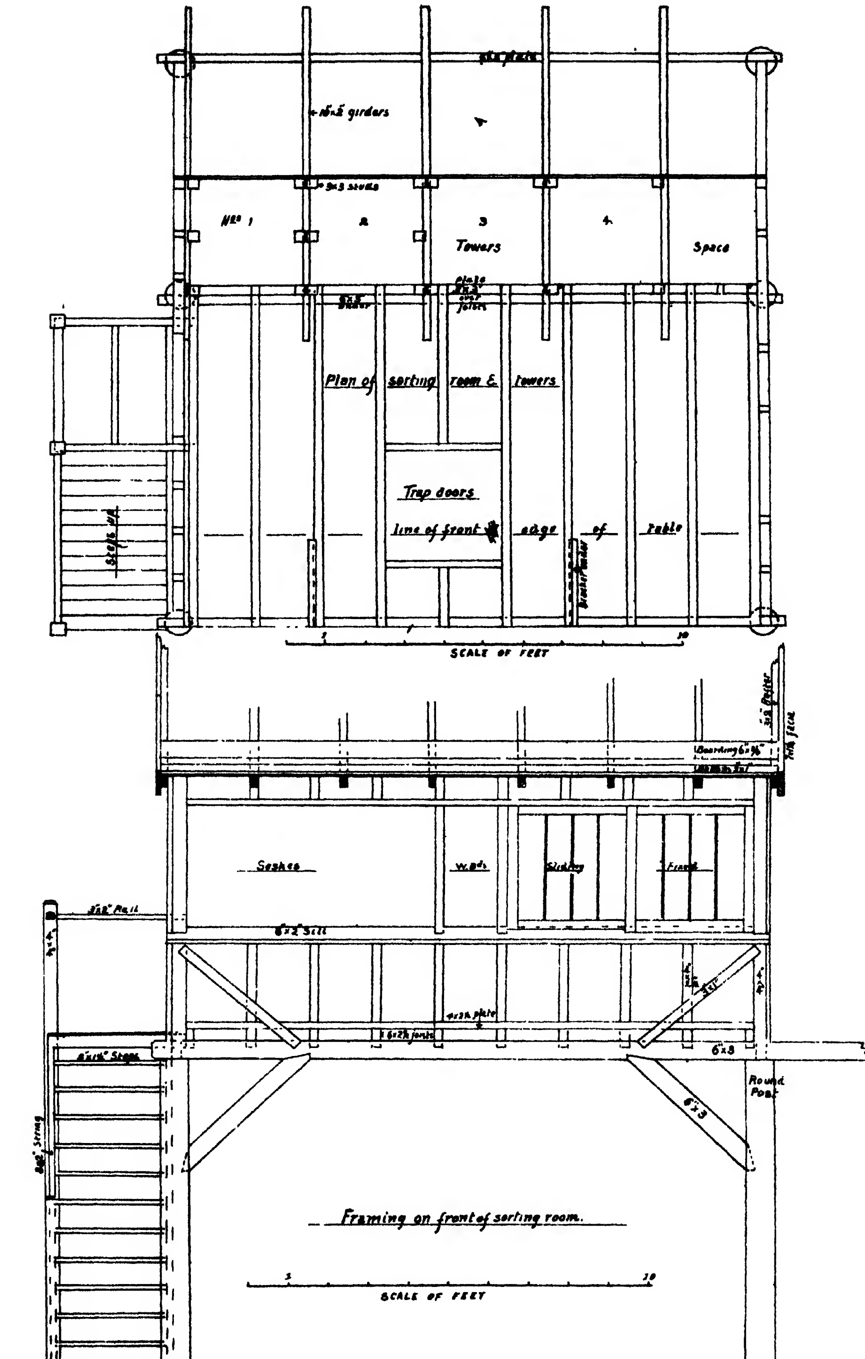
End view of Evaporator in use at the Hawkesbury Agricultural College Orchard.

first-rate insurance. On the coast, and notably in the fruit districts of the county of Cumberland, a better means of handling a great deal of the crop of summer fruit could not be availed of; a fruit-drying plant would cost one-tithe of a small canning plant; there is no expense for sugar and cans, and the skill required for drying can be attained in less time than that required for canning. From this it must not be inferred that fruit drying is advocated under all circumstances and conditions in preference to canning or pulping, but it is perfectly feasible for one or two even small growers to have an evaporator, while to run even a small cannery entails a large outlay for plant, labour and sugar, which would most certainly be beyond the means of the majority of individual fruit growers.

At the Hawkesbury Agricultural College there is a very complete evaporator, which is fully illustrated, all the details of construction being shown. It would



PLAN AND ELEVATION, FRUIT EVAPORATOR, HAWKESBURY AGRICULTURAL COLLEGE.



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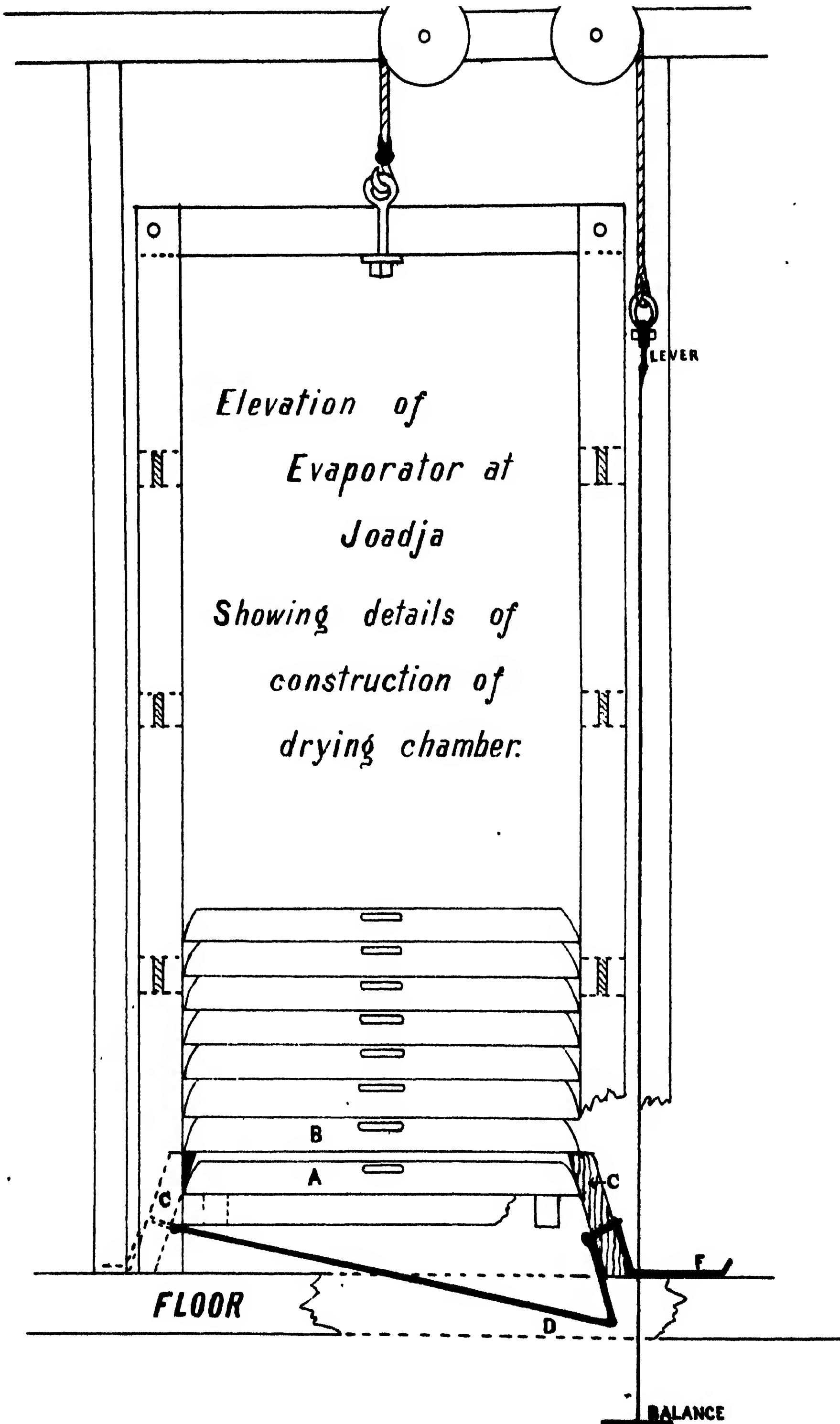
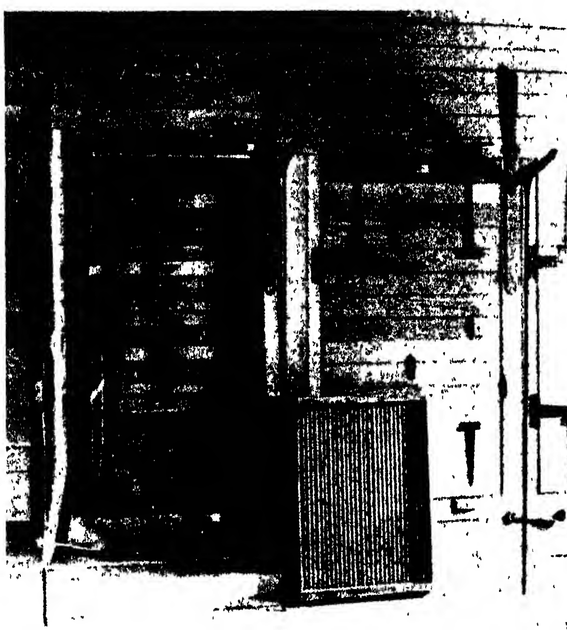


Elevation of Evaporator at Joadja Showing details of construction of drying chamber.
LEVER
B
A
C
C
F
FLOOR
D
BALANCE

no doubt, be necessary, if one was being built, to make various changes in design, without in any way altering the salient features; an existing building might be converted, or material of a different description might be available; but these are details of which each builder must be his own judge. Anyone contemplating building a machine is strongly advised to visit the College and make himself familiar with the requirements of an evaporator, and thus save spoiling a lot of good material carrying out experiments that have been carried out before. The tray is an important feature of the apparatus—in the illustration of the Joadja drier is seen a tray standing on edge. This shows



Front view of Drying Chamber, showing construction of doors, tray, and position of lever, Joadja Evaporator.

how the slatted bottom is made. The dimensions of a good tray are,—length, 3 ft. 2 in.; width, 2 ft. 6 in; with thirty-nine slats running the short way of the tray made of wood one-third of an inch square. The wood used should be of a kind free from gum or anything likely to impart a taste to the fruit; Richmond River Pine, Silky Oak, and Beech are probably the most suitable among Australian timbers. At the Australian Kerosene Oil Company's orchard at Joadja, about 18 miles from Mittagong, there is a splendid evaporator, consisting of eight chambers. These are on the Hawkesbury Agricultural College plan, with, however, some very good improvements devised by Mr. Easson, the Company's manager. The Department of Agriculture, by the courtesy of the Directors of the Australian Kerosene Oil Company, have obtained some photographs and details of construction

of their evaporator, which are here reproduced. The main improvement is in the introduction of a tray for holding the fruit, with bevelled sides. This enables dogs—arranged on either side of the drying cage, which can be raised or lowered by means of a hand lever—to engage the sides of the trays, leaving the bottom one free to be removed. An examination of the sketch will clearly show how this is effected. By this means the bottom tray, which is always finished first, can be removed and the whole let down, when the second tray becomes the bottom; a fresh tray of fruit can

View of Drying Chamber, showing bottom tray free in process of withdrawal, lever and rod carrying balance weight.

then be added at the top, and so on, as long as there is any fruit to dry. The arrangement of the doors is the same as at the Hawkesbury. In connection with the heating apparatus, Mr. Easson has been most careful to have all the flues accessible for cleansing, by leaving loose bricks opposite the ends of the iron flues; the first iron flue—that is, the one leading from the fire-box—is made of half-inch iron. This is necessary—the original tube, of light

gauge sheet-iron—being burnt through during the drying of a batch of fruit, causing a lot of trouble. It is now, as stated, a good thick tube, and likely to stand for some seasons.

The supply of air to the kiln is regulated, as is also the outlet from each chamber, by dampers; in this way an even temperature can be maintained. Mr. Allen, Fruit Expert to the Department of Agriculture, visited the Joadja orchard recently, and expressed the opinion that this evaporator was the best he had seen in the State. There is nothing in either the Joadja or Hawkesbury evaporators that cannot be built by a carpenter or handy man; the essential features are the same in both, but the improvements made by Mr. Easson make this machine a handier one to work.

The Department of Agriculture has also a fruit evaporator at the Wagga Experimental Farm which does good work, but is not considered by Mr. Allen to be so up-to-date as that described as being in use at the Hawkesbury College.

GRASS-TESTING PLOTS AT WOLLONGBAR.

THE only way to have good pastures is by testing and trying all varieties of grasses that may come under notice. This is being done, and although we may, perhaps, have a number of useless varieties for this part, it is undesirable to discard them from our collection, as they may be found quite suitable for parts other than this. The very keenest interest is taken in our grass plots, and as the time has now arrived for removal to larger areas, for feeding tests, keener interest will no doubt be felt as to the ultimate results of the tests. The Rhodes Grass is maintaining its place as a valuable grass, and is well worthy of trial by those interested. Evidently it is going to receive a trial, as over 6,000 roots have been distributed all over the State from this farm. ***Paspalum dilatatum*** has proved the best all-round grass for general purposes. Other varieties of Paspalum are not recommended, such as ***P. virgatum, P. platycaule***, and others. They are in no way suited to our requirements or conditions. There is one variety well worthy of trial, viz., ***P. Dammara***, Russell River grass. This is one of the varieties to be set out in a larger area. Some new grasses have been tried this year, but none have made sufficient progress or shown any particular virtue great enough to specially recommend them. Of course, trials will be continued in order that all possible information of a definite character may be obtained. The following varieties are in the plots under observation:—Pas. dilatatum, Pas. virgatum, Pas. Dammara, Pas. platycaule, Panicum maximum, Panicum spectabile, Kangaroo grass, Pip. paradoxum, Pip. Thomassi, Panicum paroaflorum, Giant Lyre, Texas Blue, Kentucky Blue, Swamp, Mitchell, Mesquite, Phallaris, Commatata, Pappaphorum naginatum, Pappaphorum appertum, Himalaya Fairy-grass, and a few new varieties quite unknown to us as yet.—C. H. GORMAN, ***Annual Report.***

Sewage Disposal in Small Gardens.

A. F. T. SOMERVILLE,
Gordon, N.S.W.

ONE of the imaginary troubles in many of our suburbs and country towns is the disposal of house sewage and refuse. I say "imaginary" because, in, perhaps nine cases out of ten, this trouble can be easily overcome. In our suburbs the absence of efficient methods of disposal often lies with the architect, who, as a rule, has only a very hazy idea on the subject of sewage, and none whatever about its chemical properties, and there being no sanitary engineers, in the proper sense of the name, each householder has to experiment for himself, or learn what he can from the experience of others.

All household sewage and waste can be disposed of to advantage in a garden, and as most suburban allotments—outside of the Water and Sewerage Board influence—are not less than 200 feet deep, there should seldom be anything to prevent one having a garden full of flowers or vegetables in a fairly flourishing condition. There are several methods by which sewage can be applied to the soil, but it must be kept in mind that no system will succeed if rain-water is allowed to enter the drain-pipes of such system.

One of the most modern methods of treating sewage from water-closets and house sinks, &c., in our suburbs, is the septic tank. As a rule, however, it is a failure, chiefly on account of the excess of clean water that is permitted to enter the settling chamber and disturb the bacteria which are busy satisfactorily making a crust on the surface of the sewage. Until this difficulty can be surmounted, I prefer the dry-earth system to the water-closet, well laid and ventilated drains for house water, and separate drains for the rain-water.

Commencing with the disposal of the contents of the closet pan, let the emptying be frequent so as to cover a much larger area of ground than is the case when the pan is allowed to reach a disgustingly full condition. House slops should never be thrown into it under any circumstances, nor should it be used as a urinal, otherwise it will be difficult to keep down the very unpleasant odour that will permeate the neighbourhood. Each time the pan is used throw in about 2 lb. of fine dry earth or the same bulk of wood ashes—coal ashes are no use—and you will secure a mixture that is not too strong for plant life, and which will cause a most surprising growth of almost anything. It should be put in a hole 15 to 18 inches deep and covered with earth at once. There is a deep-rooted prejudice against the use of night-soil for growing vegetables on, but after twenty years continuous practice of this method, the writer is unable to say that there is any danger to health through using it, nor has he ever read

of any; nor has he the slightest doubt in his own mind about the perfect safety of using night-soil in his garden. Of course this does not apply to excreta from typhoid patients, for instance, which should invariably be buried in a deep pit, beyond the possible reach of any vegetable root.

Next to the disposal of the pan contents comes that of the house slops. These are best poured from the slop-pail into a hole, say, 18 inches deep, adding a trowel-full or more of earth each time till the hole is full, then dig another one. No unpleasant effects will arise, and the surrounding ground will receive a gradual and useful saturation of urine.

The bath, basin, wash-tub, and sink water has now to be considered. This must be removed by pipes only, unless the family is anxious to reduce its numerical strength by courting an outbreak of typhoid, which is sure to happen, sooner or later, if this class of sewage is allowed to spread over open spaces. The pipes to be used should be of earthenware, straight, evenly glazed, socket-jointed, laid with cement-mortar in the joints, to a fall of not less than 1 foot in 40 feet, which is the minimum fall allowed by the Water and Sewerage Board for pipes 4 inches in diameter inside. No larger pipe is required for any dwelling in existence. The bottom of the trenches, say, 18 inches deep, should be graded carefully and soft places filled in and rammed, to prevent the pipes sinking when the trenches are filled again. Waste-pipes from the bath and sink should discharge over an open gully made of glazed earthernware, trapped and fitted with a movable iron grating. The drain-pipes should be continued past the gully that is highest on the site, to any convenient position, finishing with an earthenware bend. Into this fit a galvanised-iron pipe to carry away any gas that may accumulate in the drains and which exercises a certain amount of pressure at the highest point. This ventilating pipe must be 4 inches in diameter; secure it to the wall and take it up about 8 feet above the eaves. The foot of ventilating pipe to be carefully cemented into the drain, and the top to have a hood or cowl. The gully gratings should be removed occasionally, and the bottom of the gully cleaned and flushed. The kitchen sink should also be flushed with a bucketful of boiling water, say, every washing day, as the waste-pipe is liable to become choked with grease in course of time.

Having described the method of conveying waste water from the building to the garden, the next thing is to distribute it to the greatest advantage. Much will depend on the lay of one's land. If nearly level or falling at the rate of, say, 1 foot in 100, I prefer the pit and agricultural drain-pipes distributing underground from same. In this system the house drains, before described, will end at a covered pit 3 feet in diameter and about 2 feet deep, built of 4½ in. brickwork, laid without mortar. From this pit lay an overflow pipe, and just below it a main of 3-inch agricultural (or field) pipes at a depth of 12 to 18 inches, and having a very slight fall. At right angles to this, and joined to same, lay branch drains of same diameter, spaced about 5 feet centres, the top of the pipe to lie 12 inches below the surface—not more—as this is enough to prevent a spade striking a pipe violently. From 100 to 200 lineal feet of piping is enough—the writer has used 100 feet for

cottages and found it ample. The pipe-joints require no mortar, but a piece of tile or brushwood laid on top of the joint is a decided assistance to the escape of water where the soil is at all inclined to pack tightly. The drawback to this system of distribution is that it may silt up in a couple of years, but the lifting and relaying of the whole 100 feet of pipes is not a herculean task, and the results justify it. Last season the writer succeeded by this system in growing twenty-seven pumpkins on one vine, none smaller than was sufficient when cooked for two meals for the family; and one melon vine produced fourteen 'melons, the gross weight of which was within a few ounces of 218 lb.—all which was made into jam. It was easy to see where the drains were effective by the satisfactory and vigorous growth of the Cape gooseberries, tomatoes on 5-feet trellises, beet, rhubarb, cucumbers, thousand-headed kale for green feed for the poultry, and so on. With better soil and more manure, I have no doubt that other suburban residents could easily beat this record.

Another method of distribution is by open V-shaped wooden troughs, raised a little off the ground and fitted with plugs at convenient distances. Galvanised-iron should not be used as holes soon appear when anything but clean water runs over it. This trough system works very well, but it involves constant attention and labour afterwards in loosening the surface which soon cakes owing to the traffic near the troughs, especially in wet weather. It also means pumping when the land is level, and very little of that kind of labour satisfies a city amateur in summer-time.

A third method is to lay out the garden in long narrow beds with an open drain at each side, the bottom of which is rounded. The water is led as before to another open drain at the head of all the long beds and, of course, at right angles to same. A shovelful of earth will then divert the water to wherever it is required. This system also works very well, but there must be plenty of cultivation at the same time.

There now remains the solid matters from the house, yard sweepings, and poultry droppings. Bury everything in your garden that will rot, except bones, bark, and sawdust—the bones take too long, and bark encourages wood-lice. Fowls are able to eat a little of the waste, and what they leave can be swept up and buried. Also bury all grass parings (except couch) and weeds. It is surprising the number of barrow-loads that you will turn under in a year, much to the benefit of the soil, and much to the destruction of garden pests which lurk everywhere.

The before-mentioned methods of sewage disposal apply only to small gardens, certainly not more than one-twentieth of an acre—any larger area would require augmenting from tanks, or the city water supply.

In conclusion, I may say that the underground pipe system is largely used in America for grass lawns, the pipes being only 2 inches in diameter, laid 6 inches below the surface and often only a foot apart, but the writer has no personal knowledge of the results.

It is worth mentioning here that pumping water containing typhoid germs on to vegetables which are eaten green is a dangerous practice, though it is one that I note is adopted by some owners of septic tanks.

Windmill Irrigation.

T. WHITCHURCH SEAVER, B.E.

It must seem strange to any person who has considered the subject that the great natural forces of Nature have of recent years been so much neglected in connection with the production of power for industrial purposes. I say of recent years, for up to the time of the practical development of the steam engine such powers were largely employed, ships were driven, and corn ground by the force of the wind; whilst on every river water-wheels supplied power to all kinds of machinery. With the perfection of mechanical appliances, however, all this was changed, and the steam engine became almost the sole source of power, windmills and water-wheels becoming things of the past. Not long ago, however, another change took place. In the case of the steam engine, it was found that the complicated system of pistons, valves, and cranks could be got rid of, and the direct force of the steam utilised. Water-wheels were again used to develop power for various purposes, but they were greatly improved, and received the name of turbines; and by the employment of these machines Niagara Falls have been harnessed for the use of man. The old Dutch windmills have given place to strong and elegant constructions of wood and steel, and are now widely used for irrigation and other purposes.

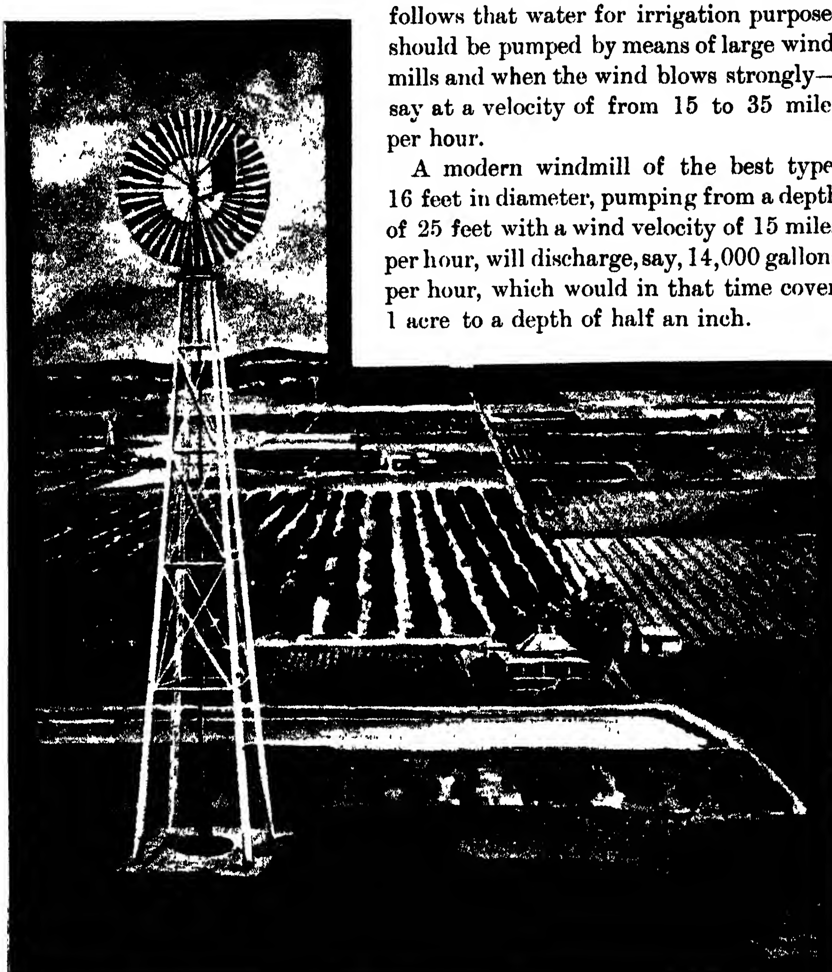
"I doubt if the fact is fully realised," said a speaker at a late convention of Weather Bureau officials in the United States, "that there is sufficient power which can be had for the taking, within 100 feet from the ground, in a space of 5 yards in diameter, to do all the work to be done on a 40 acre farm." "It is certain," he said, "that if the energy which passes through this span were properly utilised, the man who owns such a farm might avoid every physical exertion in carrying out the tasks of living and farming. Each man so situated would be simply the engineer, who directs the application of the energies which the heavens furnish him."

Windmills are generally used in this State for the purpose of pumping water from wells to high storage tanks of small size. Under these conditions, of course, very little water is pumped, even during strong winds, besides which, as the tanks soon become filled and overflow, the mills become useless at the very times they should be pumping water. If, however, instead of this condition of affairs, windmills of very much larger diameter were used to pump water a small height, say, over the banks of a creek into reservoirs of larger capacity, the power of the mill would be constantly utilised, and good results would be obtained.

The number of revolutions of a windmill, and, therefore, the number of strokes made by the pump piston, increases directly with the velocity of the wind, but its pressure increases as the square of this velocity, and its energy

as its cube. So that the theoretical energy of a cubic foot of air moving, or a velocity of V feet per second, and striking against one square foot of surface, is $\frac{W.V^3}{2.g.}$ pounds, and the available horse-power is $= \frac{A.V^3}{1,080,000}$ A being the sail area in square feet, and V the velocity of wind in feet per second. Windmills of a small size are not effective in high winds, nor are large ones of much use in low winds, from which it follows that water for irrigation purposes should be pumped by means of large windmills and when the wind blows strongly—say at a velocity of from 15 to 35 miles per hour.

A modern windmill of the best type, 16 feet in diameter, pumping from a depth of 25 feet with a wind velocity of 15 miles per hour, will discharge, say, 14,000 gallons per hour, which would in that time cover 1 acre to a depth of half an inch.



Irrigation by Windmills.

In Sydney, where the average hourly velocity is 9½ miles per hour, we may calculate on this velocity for half the day; and in the back country, where the average hourly velocity ranges from 4·66, at Wilcannia, to 3·2, at Dubbo, we may expect it for 6 hours out of the 24. So that, by applying these figures, we may calculate on 30½ million gallons being pumped in one year, a quantity which would properly irrigate, say, 60 acres. The cost of such a mill would

be about £80, and six of them would irrigate 400 acres at a total cost, including interest on plant and works, of 7s. 6d. per acre. This, of course, could only be effected by pumping into a storage reservoir, which should be constructed close to the river bank, from which the fall is always outwards. In the case under consideration, storage should be provided for half the amount pumped, or, say, 2¼ million cubic feet, at a cost of about £225, the interest on which would bring the total cost per acre up to 8s. 9d., as against £1 by steam pumping.

It may not, however, be convenient to construct storage reservoirs, either on account of their cost, or of the absence of a suitable site for the purpose. In such cases the ground itself may be used for storage purposes, and the water not required for surface irrigation allowed to soak into the subsoil. This method, known as winter irrigation, is being largely used in America, as it leaves the soil damp and in a good condition for ploughing in the spring.

It is, however, in the irrigation of small farms, say, from 20 to 40 acres, that this form of power can be employed most successfully, and the storage sight presented to the traveller, as he passes through a district dotted over with these mills, has thus been picturesquely described by a writer in a recent magazine :—

"Could Cervantes' mythical knight-errant, Don Quixote, sally forth on the prairies of the middle western States to-day he would find home-made windmills that, for grotesqueness, would outrival those he fought on the Spanish plains of Montiel. The Don would encounter all sorts and sizes, from giants to dwarfs, some with arms, that would seem to him quite two leagues long, and others with no arms at all."

The most striking example of windmill irrigation is to be found on the plains, once known as the "Great American Desert," in Kansas, a region so arid and barren that the builders of the Santa Fe railroad in 1871, on reaching its borders, turned abruptly southward from their direct course. The march of civilisation, however, was not to be stopped, and the land was taken up for cattle-raising purposes until it was found that good crops could be grown, provided they had the moisture. Then irrigation from the Arkansas River was tried, and hundreds of thousands of dollars were spent in building irrigation ditches, but it was found that the river was generally dry when water was most required, and the whole scheme proved a failure. Then it was in 1889 that windmill irrigation was proposed at Garden City, Kansas, and from that time the prosperity of the whole community progressed by leaps and bounds. The wind, which before had shrivelled and burned these crops, now proved the salvation of the farms, and Garden City found itself in the centre of an oasis, in which farms of 25 acres net their owners close on 2,000 dollars a year. The windmills cost about 200 dollars each, and the water is pumped from shallow wells, about 16 feet deep, into reservoirs, 75 feet by 150 feet and 6 feet deep, which in an ordinary wind will be filled in 48 hours. It has been proved that one such windmill and reservoir will supply sufficient water to irrigate from 10 to 20 acres with the most astonishing results. Cabbage crops have been sold for 700 dollars per acre; 30 tons of

sugar beets and 8 tons of lucerne have been produced to the acre, and a crop of celery, raised on a plot 7 by 170 feet, netted a profit to the grower of 75 dollars.

After it had been proved that windmill irrigation was a success at Garden City it spread to other localities in western Kansas and then through various other States, and, although water could not always be obtained at shallow depths, it was proved that by the employment of larger windmills it could be economically raised from depths as great as 150 to 200 feet.

In this State there seems to be no reason whatever for the deplorable state of things which often exists in the plains of the interior.

It is a fact that well-grassed paddocks are often rendered of no value owing to the absence of water, and also that in many cases stock die of drought when they are actually standing over a running stream which only requires to be raised to the surface to provide an ample supply.

It may not be generally known that of the total amount of rain which falls on the catchment area of our rivers only from 1 to 2 per cent. actually flows down those channels into the sea. A very large amount of this rainfall sinks into the ground, and forms the artesian supply to which so much attention has recently been drawn; but there is another immense flow of what is known as "sub-artesian water" constantly percolating through the sands and gravels of the Tertiary drifts. In the coastal districts this water may be obtained at very shallow depths, say up to 50 or 60 feet, and on the level inland country an average depth would be about 120 feet.

The best mechanical means of getting this shallow water is by boring by means of the "spring poll" system, which is fully described by Mr. W. Gibbons Cox, C.E., in the *Agricultural Gazette*, October, 1905.

The practical question for would-be irrigators is not so much whether good results can be obtained from irrigation, as whether it will pay, and the expenses connected with the running of a steam or oil engine often renders the enterprise a doubtful one.

By the employment of a windmill, of a suitable size, and working under suitable conditions, not only is a great deal of expense and trouble saved to the irrigator, but so long as the wind blows the water is constantly being pumped into his storage reservoir.

Windmills are useful for the purpose of driving machinery on a farm, but, of course, the drawback is that when there is no wind there is no power. It may, however, pay in many places to pump the water into a high reservoir from which it will run out when required, and work a turbine. A 20-foot windmill, with the wind blowing 15 miles per hour, will raise, say, 18,000 gallons of water per hour to a height of 50 feet, or, say, 3,375,000 gallons in a week. Now this amount of water is equal to a flow of $1\frac{1}{2}$ cubic feet per second, which would be sufficient to develop 6 h.p. for 100 hours.

A good plan would be to have two windmills, one to be used for irrigation, and the other for the purpose of supplying the storage reservoir; in the latter case, if the water supply is very limited, it may be used over and over again by having a reservoir at the pump, and re-raising it.

In conclusion, I would say that the use of windmills is by no means a thing of the past; they are increasing in power and efficiency as well as in numbers as their importance becomes more widely recognised. In such an up-to-date city as San Francisco, one has lately been erected for pumping purposes, and its daily record ranges from 5,460 gallons to 371,397 gallons raised from depths of from 80 to 123 feet.

Let farmers and others make use of the water which flows unheeded beneath their paddocks, and of the winds which, for the taking, will supply them with power, and so, by the cheapest and easiest method, increase the production of their holdings.

Phylloxera-resistant Stocks.

The brightest feature throwing light of reasonable hope for a return in the districts now suffering from the effects of phylloxera to the state of buoyancy existing before this calamity overtook them, is the general favour and the confidence that people place on the phylloxera-resistant stocks which this Department distributes at a nominal cost to all applicants within the infected area who wish to either reconstruct their vineyards in which the pest exists or for the planting of new ones. More than that was done last year by granting 500 stocks free of charge to any applicant within the county of Cumberland and that of Camden. An accurate idea of the rate at which the reconstruction of vineyards is proceeding may be gained by the number of resistant stocks supplied by the Department for the planting season of 1904.

Over 6,000 stocks were scattered over phylloxera-infected zones, and, when we consider that the distribution of these stocks went on for the four preceding years, it is plain that not only the vine-growers are convinced that these are the only means to stay the disastrous effect of the disease, but that the stock reared at the State's Viticultural Station near Howlong are a success. We have heard of one or two instances in which these stocks failed, and the growers concerned were inclined to believe that the resistant vines had not stood the attacks of phylloxera. On close investigation of the cases, which I made personally, it was evident that it was due to unfavourable weather conditions. Suffice it to say, that the stocks alleged to have failed to stand phylloxera were the Rupestris du Lot and the Riparia and Rupestris Hybrids, 3,306 and 3,309, and any person acquainted with this branch of viticulture would know that these sorts are among the most resistant. However, the very growers who ventilated this alleged non-resistance and death of these stocks are now among the most sanguine to secure a large number of them for this planting season.—M. Blunno, *Annual Report.*

Wheats available for Distribution.

W. FARRER.

PARCELS of the following wheats will, so far as the stocks which are available allow, be distributed in trial parcels to farmers of this State who may apply for them. Applications should be addressed to the Director of Agriculture, Sydney.

1. "Federation."—This variety has done so well, and shown itself to be so productive, that it ought to be tried in all but the coastal and the coldest districts of the State. As has already been pointed out, this variety is of relatively little value for the quantity of straw it produces, and is inferior as a hay-wheat; nor is it resistant of bunt, and only in a slight degree of rust. Its value comes from its yielding qualities, its ability to hold its grain in storing, its earliness, and the good quality of its straw. As regards its qualities in the mill, the flour it yields is somewhat better (stronger) than that of Purple Straw, which is one of its parents. It may be classed as on the boundary between the weak and straight flour sorts.

2. "John Brown."—The reports on this wheat have not been so uniformly favourable as those on Federation, but on the whole they have been very favourable, and it evidently does well in many districts. Its milling excellence makes it worthy of a trial wherever there is a chance of its succeeding. Speaking generally, John Brown does well in the warmer districts, but we have still to learn what soils suit it the best. It is believed to be at least a fair resister of rust, but to resist infection by bunt only moderately well. Its straw is of excellent quality and of good height, and it ought to be good for haying purposes. It is a mid-season wheat.

3. "Bunyip."—This is a new variety, and thus far appears to suit warm districts the best. When well grown, Bunyip is a very pretty wheat. It cannot, however, be regarded as a resister of either rust or bunt; but its apparent productiveness, its neat growth and handsome grain, and its earliness are likely to recommend it to many farmers. Its milling qualities are about the same as those of Federation.

4. "Rymer."—This variety, although it is a parent of Bunyip, is new, and has never been sent out before. It is one of those which suffer severely from the pest—the wheat aphis—which makes the straw break down. I had condemned Rymer on account of this fault at the Cowra Farm, but when I afterwards saw what a pretty crop there was of it at Bathurst, I relented. Since then I have learnt that it has won approval at Glen Innes also. As this wheat aphis appears not to attack wheats in our cooler districts, but only in

the hotter parts of the State, I think that Rymer might be given a trial in places where it is not too hot. Rymer is a mid-season variety, and is fairly suitable for hay-making purposes. The flour it yields is much like that from Federation and Bunyip. It appears to be a good resister of rust, but bunt infects it rather easily.

5. "Macaroni Wheats."—There are now, I am informed, three establishments in Sydney and two at Melbourne where macaroni is being made. There is, therefore, a market for the grain of these wheats for macaroni-making alone. The requirements of the trade are, of course, as yet not very great—but, "as a thing begun is half done," it is quite likely that these factories will soon be making for an export trade, and that the requirements of the whole of the East, as well possibly as a good share of the Home market, will be secured by us. I think, therefore, that every effort ought to be made to help our manufacturers; and the doing of that lies mainly with our farmers, and especially with the farmers of our dry interior, for it is there that grain of the very best quality for the making of macaroni will be produced. As macaroni wheat is not used for the making of macaroni alone, but to an increasing extent both in Europe and America for the making of bread; and as the flour which is made from our soft wheats (*e.g.*, from the Purple Straws, Tuscans, &c.), would be improved greatly by an admixture of macaroni flour, I think we ought to give a preference to those macaroni varieties which are capable of producing flour that is good enough for the making of bread, as well as semolina for making into macaroni. Of these, the only one which we have yet in quantity is Cretan.

6. "Cretan."—This alone of the macaroni wheats which have been examined in our Departmental Laboratory produces flour of sufficiently good colour for bread-making purposes. The quantity of flour which it yields is also good, having been 74·4 per cent. and 70·2 per cent. respectively in the two recent examinations which have been made of it. I therefore recommend our farmers, and especially those of our interior, to give a trial to this variety. As, however, Cretan may not do so well in some localities as some of the others, which, so far as we know at present, are equally as suitable for the making of macaroni, I may state that we have seed of the following varieties also available for distribution, viz., *F.* (*R* 1) (a Russian variety the real name of which is unknown; it was erroneously sent out last season as Belotourka, but it has since been found to differ plainly from that variety), Farrer's Durum, and Velvet Don. Seed of Cretan will be sent out to applicants, as far as what is available will go, in trial parcels. If the demand is greater than can be supplied, preference will be given to applicants from the drier parts of our interior. It should be recollected that as a rule macaroni wheats are light stoolers, and on that account the quantity of seed sown should be greater than with bread wheats.

It may be of interest if I state that I have lately become possessed of a macaroni wheat which has been pronounced to be the very best for bread-making of any wheat in the world. Unlike too many varieties of this class of wheats, it yields a very high percentage (not quite so high, however, as did

Jumbuck* in the examination that was made of it) of flour, which is of excellent colour and strength. The quantity of seed that I have is very small, and it will take three years at least (most likely four) to get enough for distribution. For the present, therefore, it will be necessary to go on with Cretan.

I may state that the new Fife-Indian variety, "Come-back," which has been found in South Australia to yield flour possessing all the good qualities in the bakery of the best of the Manitobas, and does well in warm districts, is likely to be available for distribution next year; also that we shall begin this year to propagate a number of cross-bred varieties which are valuable for the resistance they offer to bunt. None of them, however, are bunt-proof, but it is expected that treatment with a 1 per cent. solution of bluestone will make them quite proof against infection, and this is by no means the case with the varieties we have hitherto been cultivating. Another point of interest is that we have found that varieties differ in the degree in which they are injured by the wheat-aphis. So evident is this that we have begun to keep records of the degree in which all the new cross-breds suffer from this pest, and those are being rejected which are injured seriously.

Fresh trials of the liability of varieties to be infected by "bunt" have again shown that the varieties "Bobs" and "Federation" are amongst the most bunt-liable sorts we have. I recommend strongly, therefore, that they never be sown without having been treated with a fungicide. An experiment which I shall describe in a future issue of the *Gazette* has indicated that it is probable that immersion in a solution of bluestone (a strength of 1 : 100 or 1 lb. of bluestone to 100 lb.—that is, 10 gals. of water would be just enough) will protect seed, which, on account of want of moisture, has to remain in the ground for a considerable time before it can germinate, and prevent it from being killed by fungoid organisms, such as moulds; and that in our dry interior it may be advisable to treat seed grain for this reason alone, even when it is known to be quite free from spores of bunt. For the present I think it will be better to avoid the use of formalin as a fungicide for seed wheat unless the ground at sowing time be moist enough to ensure speedy germination. In our dry interior, bluestone will probably be found to be the better fungicide at all times; but the seed should be *immersed* in the solution, all buntballs contained in the seed skimmed off, and the seed afterwards dried.

* This new variety is not yet available for distribution; it is hoped that sufficient seed will be available by next season.

Pigs at Newington.

In the January *Gazette* of this year appears a report on bacon, from the Acting Agent-General, in which mention is made of the prospects of the export trade; reference is also made to the stud pigs kept at the Hawkesbury Agricultural College, Rookwood and Newington Asylums, as being likely to supply a type of pig that when turned into bacon will supply the class of goods required by the English consumer.

A very large market exists in England for bacon, but it must be the class the English consumer wants; it is absolutely useless sending anything to this market but the best of its kind. English people have the choice of the world and are very conservative in their tastes. Send a good article to London, and it brings a good price; inferior goods are not wanted. In no branch of food are people more concerned than their breakfast bacon; it must be just right or they look elsewhere for their supply. From the report above referred to it will be seen how the smallest details of cutting up must be observed or the trade looks askance. These are matters over which the farmer can hardly be expected to have any control, but it certainly reflects great discredit on our butchers that there should be these frequent remarks made by the home trade about carcases being badly dressed. The farmer's province is to breed a good bacon pig; the curing and dressing should be looked after by the exporters.

With the object of letting farmers know to what extent the Government, by means of the State piggeries, is endeavouring to assist in getting a good strain of pigs established in the State, several illustrations have been made from photographs taken at Newington. Pigs are very unsatisfactory subjects to photograph; they will persist in standing just where they are seen to least advantage; but even so, it is evident that the class of animal shown leaves nothing to be desired by the most critical breeder. Mr. Megarvey, Superintendent of the Newington Asylum, has kindly supplied particulars of the stud at Newington, which are depicted in the illustrations.

From the advertisements that appear at the end of this issue, further particulars are given regarding the prices, &c. From the pure-breds for sale at the College, Experimental Farms and the Asylums, for a rather modest sum a well-bred young boar can be obtained. This crossed with good grade sows will produce good baconers. Nothing but a pure-bred sire should be used, and a good one at that; a cross-bred sire, no matter how good he may look himself, will not be satisfactory to breed from.

Berkshire Boar, "Russell Swanwick." (Imported.)

This animal is a typical Berkshire. He is now four years old, and his stock has proved to be amongst the best in the State. There is a constant demand for his stock, and orders have to be booked in advance. A number of sows sired by him now have litters by the newly imported Berkshire boar, "Ocean Wave." A large number of "Russell Swanwick" boars have been distributed amongst the farmers of the State and have given the greatest satisfaction.

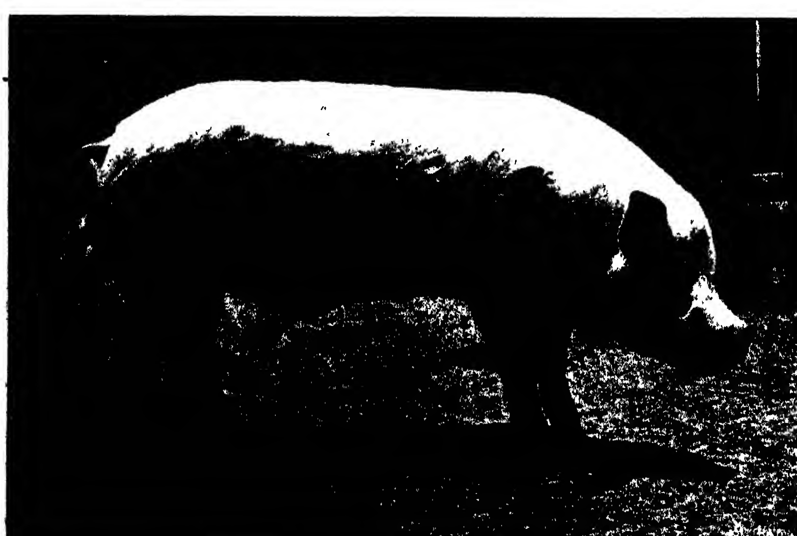
Berkshire Boar, "Ocean Wave." (Aged 18 months.)

Sire: Peter Maritzburg (No. 879); bred by C. Parons, Esq., of Hurstbourne.
Dam Cradle (No. 8,476); bred by Earl Carnarvon, of Highclere.
Cradle's grand dam, Highclere XIV (5,043), bred by Earl Carnarvon, won the Champion Prize at the Royal Show in England.

A splendid animal, imported last year. Some of his progeny will shortly be available for sale at a reasonable figure. This boar has a very short and well-dished head, which is so frequently sought for by those who breed for the show ring, and he has also a very long and deep body, which makes him a most handsome animal.

Large Yorkshire, or Large White Boar, "Ruddington Defender." (Imported.)

The boar is a splendid specimen of his breed, being of enormous length and depth. He was imported from England three years ago, and has proved himself a successful stud pig. A large number of his youngsters have been forwarded to breeders in this and other States. Those who have been wise enough to use the Large White sire for their Berkshire herds to produce market stock have been delighted with the results, and now the cross between these two splendid breeds is the poor man's pig for market purposes.



Large Yorkshire, or Large White Boar, "Sir Wilfred." (Imported.)

Also a fine animal, showing great length of side and depth of body.

Berkshire Sow, "Danesfield Lottie III." (Imported last year.)

Berkshire Sow (Registered No. 10,151), bred by R. W. Hudson, Esq., of Danesfield.
Sire: Danesfield Hampton (8,768); bred by R. W. Hudson, Esq
Dam: Buscot Lottie (8,585); bred by Sir A. Henderson, of Buscot.
Buscot Lottie was sired by the notoriously successful English prize-winner, Royal Berks (6,391). This valuable animal served in Mr. Russell Swanwick's stud, as well as in that of Sir Alexander Henderson, and other noted English breeders. Subsequently he was purchased by Mr. Vanderbilt for service on his stud farm in the United States.

This sow comes from R. W. Hudson's herd in England, and brings into this State the best strain procurable at the present time.

Berkshire Sow, "Joyce." (Imported.)

Berkshire Sow; bred by Arthur Hiscock, jun., Esq., Manor Farm, Motcombe, England.
Sire. Harrison Robert (English Stud Book Registration No. 8,978).
Dam. Harrison Pansy (No. 9,610).
Harrison Robert was bred by Lord Carnarvon, of Highclere; and the dam, Harrison Pansy, is from the celebrated blood stock owned by T. Chick, Esq., of Dorchester.

A shipmate of "Danesfield Lottie," and a very typical animal, from the herd of Mr. Arthur Hiscock, which has been very successful during late years in the English show ring.

Berkshire Sow, "Black Queen."

Bred at Newington. Sire, "Russell Swanwick"; dam, "Queen Betsy"

Group of Large Yorkshire Sows.

These are a handsome lot of breeding sows running with the boar "Ruddington Defender."

F

Timber for Butter-boxes.

F. B. GUTHRIE.

In view of the discussion regarding the relative merits of local and Queensland white pines as against the New Zealand white pine for butter-box making, the following notes on the results of chemical examinations of these woods may be of interest to those concerned.

The following table gives the result of a comparison of a sample of Richmond River pine with Zew Zealand white pine:—

		Richmond River white pine.	New Zealand white pine.
Moisture at 100° C.	=	9·36	11·26
Ash	=	0·60	—
Aqueous extract	=	1·99	2·22
Oxidisable matter calculated as oxalic acid	=	0·41	0·60
Acidity of aqueous extract as acetic acid	=	0·06	0·08
Weight per cubic foot	=	·33¼ lb	—

The aqueous extracts from both timbers were of a very pale straw colour, and practically tasteless.

The New South Wales timber yields actually a smaller amount of extractive matter when treated with water than does the New Zealand white pine, with which it compares in all respects very favourably. The "oxidisable matter" includes tannin and astringent substances generally, and of these substances, which might be expected to impart an objectionable flavour to the butter, our timber contains less than does the New Zealand. The acidity of the local wood is also less.

Samples of Queensland white pine and New Zealand white pine were also subjected to examination, the figures obtained being as follows:—

		Queensland white pine.	New Zealand white pine.
Moisture	=	9·56	9·44
Ash	=	1·18	1·66
Aqueous extract	=	1·13	1·05
Oxidisable matters calculated as oxalic acid	=	0·13	0·16
Acidity of aqueous extract as acetic acid	=	0·06	0·08

The timbers were very similar in their chemical properties, yielding much the same quantities of extract to water, and contain nearly the same proportions of astringent substances and acids; the Queensland white pine containing rather less of these objectionable ingredients.

The Queensland wood yields a slightly higher amount of extract to water, and the watery extract is somewhat more highly coloured than the New Zealand. Both are tasteless, except for a slight woody flavour, and one would not anticipate that any of the woods under discussion would affect

the flavour of butter packed in them. A practical test was made by Mr. O'Callaghan, the Dairy Expert to the Department, who used boxes made of these last two timbers, and had butter packed in them under ordinary conditions for about six weeks; and his report goes to show that there was no appreciable difference from the local commercial point of view between the butter packed in Queensland and New Zealand boxes, though a slight woody flavour was noticeable in the butter packed in the Queensland wood.

In the Annual Report of the Queensland Department of Agriculture for 1905, analyses and practical tests of the Queensland white pine, as compared with the New Zealand wood, are recorded by Mr. Sutherland Thomson.

The analytical results obtained by Mr. Brünnich, the Agricultural Chemist, are as follows:—

	Queensland white pine.				New Zealand white pine.	
	Half Dry.		Dry.		Dry.	
	per cent.		per cent.		per cent.	
Percentage of moisture in the wood	10·53		10·34		8·81	
,, ash in the wood...	·60		·64		1·57	
,, watery extract from the wood	1·10		·75		1·21	
Weight of wood (wood lb.) per cubic foot ..	38·2		40·3		30·0	
Weight of water absorbed, lb. per cubic foot ..	9·8		9·5		9·3	
Weight of water evaporated—	lb.	per cent.	lb.	per cent.	lb.	per cent.
Per cubic foot in 2 hours	3·1	31·6	3·9	41·1	3·6	38·7
,, ,, 6 ,, ...	6·6	67·4	6·2	65·3	6·5	69·9
,, ,, 24 ,, ...	8·8	89·8	7·9	83·2	8·3	89·3

The aqueous extracts of the two Queensland pines were stated to be quite colourless, that of the New Zealand pine having a light yellow colour. All extracts were almost tasteless.

The timbers were subjected to a very searching practical test by Mr. Thomson, who summarizes the results of the experiments as showing that the Queensland white pine is admirably adapted for the export trade, and conclusively contradicting any objection that Queensland pine could give an objectionable flavour to butter.

Although a sufficient number of tests have not been made of the wood of our local northern river pines to enable one to speak with such certainty, the comparisons above made shows that it compares very well with the New Zealand timber actually used for butter boxes, and the result is sufficiently encouraging to point to the desirability of instituting further careful experiments in this direction.

A Method of Separating the Clay and Sand in Clay Soils, and those rich in Organic Matter.

L. COHEN.
(Chemical Laboratory, Department of Agriculture.)

[Read before the Royal Society of New South Wales, December 6, 1905.]

CONSIDERABLE difficulty has always been experienced in effecting the complete separation of the clay and sand fractions of those soils that contain above the average either of clay or organic matter. The chief obstacle to an exact mechanical analysis of the fine soil appears to be that the particles of clay form themselves into aggregates, very often having a minute vegetable fibre as a nucleus, and these aggregates behave in the elutriator as though they were sand grains of the same dimensions. This property possessed by organic matter or humus of cementing together the clay particles, though rendering, as a rule, the texture of the clay soils (*in situ*) more open, interferes considerably with the correct estimation of the constituent particles of the soil.

The method of preparation of a sample of soil usually employed in order to separate the clay by the action of a moving current of water is as follows:—A weighed portion is passed through a sieve which retains the stones, coarser root fibres, and gravel, and the fine soil is boiled with water until the clay particles are completely separated from the sand, and the floccules broken up. In this laboratory the sieve used allows all particles to pass through of a diameter of 1-50th of an inch or less. If necessary, and this is the case with nearly all humus soils, heavy loams, and clays, the soil is rubbed through by the fingers into a large basin with the aid of water. After allowing the fine soil to settle for half an hour, the supernatant turbid water is poured off, the residue washed into an Erlenmeyer flask and boiled for half an hour or more, according to the texture of the soil. After cooling, the contents of the flask are removed to the elutriator. A Schultze's elutriating vessel of conical shape is used, 3½ inches in diameter at top and 6 inches deep, fitted with a brass rim, holder for funnel-tube, and overflow tube. The water is allowed to flow from a reservoir by means of a rubber tube delivering into a thistle-head tube, 15 inches long, leading down to half an inch of the bottom of the vessel, where it is drawn out into a small orifice. The rubber tube is about ⅛ inch in diameter and provided with a screw-clamp to regulate the flow so as to keep the thistle tube full to the head.

When the water from the overflow tube is quite limpid, the clamp is screwed tight, the residual sand allowed to settle, the water poured off, and the sand then washed out into a basin and dried on the water-bath. This process produces good results with sandy soils and light loams containing up to about 30% of clay; where, however, this amount is exceeded, as a general

rule the preliminary treatment by boiling with water alone does not yield satisfactory figures. To remedy this, several methods have been used in order to more completely break up the clay floccules into their constituent particles, of which perhaps the most efficient is that of rubbing the soil in a mortar by means of a caoutchouc pestle with a little water.

The process is very tedious and there is a decided tendency to underestimate the amount of sand present, owing to the necessity of pouring off at intervals the clay in suspension and adding fresh quantities of water. Schöne recommends boiling the soil with a 1 or 2 per cent. solution of caustic alkali. A large quantity of clay as well as fibre is present in the residue remaining in the elutriator after the treatment of soils by the above methods, especially in the case of peaty soils or those containing from about 15% and upwards of organic matter. It seemed then that the difficulty would be overcome and the complete disintegration of the clay floccules brought about by subjecting the soil to the action of some substance before elutriation, which would dissolve the cellulose of which the fibre mainly consists.

A solution of zinc chloride in twice its weight of hydrochloric acid (40% HCl) was found to be the most convenient solvent, ammoniacal cupric hydrate being unsuitable for the purpose. Thirty grams of a peaty soil from Bundanoon, containing 22·27% of organic matter, were passed in a dry state through a wire sieve having 50 meshes to the inch. The fine soil was then boiled for half an hour in a beaker with 200 cc. of the zinc chloride reagent, and after dilution the whole was washed into the elutriating vessel. After five minutes the overflow water became perceptibly clearer, and in three-quarters of an hour was perfectly clear. The weight of the residue on drying was 1·85 gram, equivalent to 6·17% of sand in the soil, the clay percentage being calculated by difference.

For purposes of comparison, 30 grams of the same soil, after being passed through the sieve, were boiled with water for 45 minutes. Three hours and a half elapsed before the overflow became quite free from turbidity, and the dried residue was found to weigh 17·1 grams; in other words, by this treatment the soil is estimated to contain 57% of sand. On examination of the two residues, that from the zinc chloride treatment was found to consist of nothing but clean, hard, sharp grains of sand with no perceptible admixture of clay. On the other hand, by the water process the residual "sand" was almost entirely made up of clay floccules of the dimensions of medium sand grains, each floccule or aggregate appearing to be composed of minute particles of decayed vegetable matter to which adhered clay and particles of sand. The heavier sand grains were observed to settle down rapidly after the current of water was stopped, but the major portion of the sand was distributed throughout the clay, &c., which deposited more slowly. In order to compare the disintegrating power on the clay floccules, of the zinc chloride reagent, and the 2% alkali solution recommended by Schöne* for soils rich in humus, 30 grams of the same soil were boiled in 250 cc. of a 2% solution of caustic soda for 1 hour, the gravel, &c., having been previously removed as in the other cases.

* Wiley *Agr. Analysis*, Vol. I, page 219.

Great care was necessary to keep stirring before coming to the boil, as the soil becomes very flocculent and settles rapidly. The elutriation took 8 hours, the dried residue weighing 6·4 grams, equivalent to 21·3% of sand in the soil. The appearance of the "sand" presented the same defects as those observed in the water process, though in a lesser degree. Apparently the effect of the alkaline hydrate is beneficial to a certain extent, dissolving the *humus* which has a binding effect on the clay particles, but exerting no solvent action on the vegetable fibre itself (cellulose). The superiority is apparent therefore of a reagent that will eliminate both these causes of adhesion of the particles.

In order to test the value of strong nitric acid in this direction, 30 grams of the fine soil were boiled in the strong acid for 1 hour. The reaction in this case is very violent and there is great difficulty in preventing the whole from frothing out of the vessel, great care being required, especially on first warming. On dilution with water, gummy masses (cellulose nitrate) separate out, and are an obstacle to proper manipulation. The soil treated in this way required 3 hours to elutriate, the weight of residue being 5·9 grams. The latter in this case was cleaner than that produced by the alkali method, but still contained considerable quantities of clay and organic matter. Thirty grams of the same soil were also treated by heating with dilute hydrochloric acid to boiling in a beaker, powdered potassium chlorate being cautiously added, a little at a time, as the reaction is violent and attended by the escape of large quantities of chlorine. The boiling was continued for half an hour, and on elutriation 4·5 grams of residue remained, possessing the characteristics of that from the previous experiment. The overflow water became quite clear in 1 hour 45 minutes.

A stiff yellow clay soil from the Dorrigo Scrub, from which by boiling with water it was impossible to obtain reasonable figures for the sand and clay percentages, was treated by boiling 30 grams with 150 cc. of the zinc chloride reagent for half an hour. The elutriation in this case took 15 hours, but the residue after this time was a pure, clean, sharp sand, the grains varying considerably in size, entirely free from both clay and fibre, and weighing 2·8 grams, making 9·3%. The same soil by the pestling process yielded 1·6 gram sand, showing the very considerable loss of sand that occurs in this method. This soil contained a rather large amount of organic matter, viz., 15·66%, though from its appearance and physical properties it could not be classed as a humus soil.

Most of the soils from the Myall Creek Estate, recently thrown open for settlement, presented much difficulty in the mechanical analysis, and the most unpromising of these, an exceedingly stiff black clay, was selected in order to test the effect of the zinc chloride reagent. The soil, after pestling for some 5 hours, had yielded 9·2% of sand. Being too stiff to pass through the 50-mesh sieve in a dry state, 30 grams were allowed to soak in water for 15 minutes, and being by this time softened were rubbed through the sieve into a large porcelain basin. After standing for half an hour the supernatant liquid was poured off and the soil washed by means of 200 cc. of the zinc chloride reagent into a beaker. Forty-five minutes were allowed for boiling,

and the elutriation took 4 hours. The residue was of a whitish colour, and, observed under the microscope, was seen to consist of both rounded and sharp perfectly clean grains, of varying size, no fibre or clay particles being present, and weighing 8·55 grams.

The use of a solution of zinc chloride as described above will therefore be seen to be of great service in estimating the sand and clay in all soils with which other methods of treatment, preliminary to elutriation, give unsatisfactory results. Speaking generally, all heavy loams and clay soils, as well as those containing more than the average quantity of organic matter, such as humus and peaty soils, may with benefit be treated by boiling with a solution of zinc chloride in twice its weight of hydrochloric acid, previous to elutriation in any of the usual apparatus.

TABLE showing the percentage of sand obtained on elutriation of four typical soils, after treatment with various reagents.

Soil.	Organic matter per cent.	Percentage of Sand.					
		Boiling with $ZnCl_2$ in HCl.	Boiling with Water.	Boiling with 2% Soda	Boiling with strong HNO_3	Boiling with HCl and $KClO_3$	Pestling.
Peaty soil from Bundanoon	22·7	6·17	57·0	21·3	19·7	15·0	...
Stiff yellow clay from Dorrigo Scrub ..	15·7	9·3	34·2	16·6	14·0	...	5·3
Stiff black clay from Myall Creek	8·6	28·5	...	..	...	...	9·2
Swampy soil from near Manly	35·9	·7	48·2	5 3	7·0	...	..

Superphosphate in Manuring Wheat.

F. B. GUTHRIE.

In the great majority of cases the manuring of wheat lands resolves itself into the application of a small quantity of superphosphate, either applied broadcast on the land or drilled in with the seed when sown. In this respect the practice is opposed to that which prevails in the older wheat-growing countries of the European Continent, England and America, where the application of nitrate of soda is almost universal. With us the application of nitrate of soda (or of ammonium salts) by itself is found to be of little or no benefit, whereas in many cases the addition of a small proportion of superphosphates in the early stages of the plant's growth ensures an increased harvest. The soundness of this view has been confirmed by exact experiments carried out in all the Australian States, including our own. The reason of this want of response to nitrogen in the wheat crop is, I think, to be found in the different conditions as to rainfall under which the crop is grown, and the effect thereby produced in the natural formation of nitrates within the soil.

In Europe the grain, sown in autumn, remains dormant after germination for four to five months during the late autumn and winter, its period of active growth being practically confined to the months of April, May, and June, and is particularly active in May and June. It is during this dormant period that the greatest fall of rain takes place. The ground is covered with snow during the winter months, and during the thaws, and particularly when the frost breaks up in February and March, the soil is subjected to a very heavy leaching. This applies more particularly to Northern Europe and America, where there is little thawing during the actual winter, and the whole of the accumulated snow melts in a comparatively short time, flooding the land, and leaching out the nitrates which have been produced during the previous summer and autumn. The leaching process is continued by the spring rains—which are usually fairly heavy—of March and April, so that when the plant enters upon the period of its most active growth in May, the soil's store of nitrates is removed beyond the reach of the roots; and the addition of readily available nitrogenous manures such as nitrate of soda or sulphate of ammonia is essential for a satisfactory harvest.

The Rothamstead experiments show that nitrification is most active during summer and autumn, the formation of nitrates increasing from July to October. When wheat was grown at Rothamstead after fallow the increased yield was found to be almost wholly due to the retention in the soil of the nitrates thus formed in the summer, and depended upon whether the fallow was succeeded by a wet or comparatively dry autumn. Should a wet autumn and early winter succeed, the nitrates are washed so far down in the subsoil as to be out of the reach of the crop, which then shows a very small return for the previous summer fallow.

The Rothamstead experiments also show that there is little or no nitrification going on during the three months preceding harvest, that is during the period of the plant's most active growth. The period of active nitrification begins about mid-summer, and continues with increased activity during late summer and autumn after the grain is harvested. The nitrates thus formed are to a greater or less degree washed down into the subsoil during the rains of autumn and the thaws and rains of late winter and early spring. Hence the great importance of the use of nitrogenous manures in these countries. The Rothamstead experiments show further that practically the whole of the nitrogen supplied as ammonium salts is nitrified during the season of growth of the wheat, and whatever is not removed by the plant gets washed down as nitrate into the subsoil. With us the condition of things is very different. During our mild winter the wheat plant, once well started, is making steady and continuous growth the whole time, from April or May, when the seed is sown, till December. The months succeeding harvest are usually comparatively dry and warm and favourable to nitrification. The seed is then sown, and the plant germinates in land in which nitrates are abundantly present, and as there is practically no dormant period the plant gets the full benefit of this, at least during the early stages of its growth, until it is well established. The greater portion of the rain falls

(at least in the principal wheat-growing districts) during the winter months, June, July, and August, when it is of the greatest benefit. If these months are dry a failure in the harvest is almost certain, unless rain falls in September or October. Nitrogenous manuring alone is, therefore, of little benefit under our conditions. What the wheat crop appears to need is an application of fertiliser to enable it to make a vigorous growth at the outset, and this would appear to be supplied by the use of readily available phosphatic fertiliser.

The principle adopted by most of our farmers of applying with the seed a small quantity of superphosphate is a perfectly sound one, and on new land, or fairly rich land, the use of a complete manure is unnecessary.

On account of the undoubted benefits attending the use of small quantities of superphosphate for the first few seasons, the notion is not uncommon that a small annual dose of superphosphate drilled in with the seed is all the manuring which the wheat plant requires.

This is, however, not the case, and superphosphate alone is not a complete manure for wheat or any other crop. The initial advantages as to increased yield are not maintained in succeeding seasons.

This is well shown in the following table which gives the yields obtained in successive seasons from some of the experimental plots at Wagga in the charge of Mr. Helms. The figures quoted have previously appeared in the *Agricultural Gazette* in the reports on the respective harvests, and are brought together for the sake of comparison :—

No. of Plot.	Nature of Manuring.	Yield per acre (bushels).			
		1900.	1901.	1903.	1904.
1	No manure	7⅔	17⅔	20⅔	11
3	Superphosphate only	13⅓	22⅔	33	14¼
8	Sulphate of ammonia, superphosphate, sulphate of potash	10	20⅓	32⅓	15⅓

The harvest of 1902 is not included, as it was a failure owing to drought, and the plots were not weighed.

In the first year (1900) the increased yield over the unmanured plots due to the use of superphosphate alone was 74 per cent. as against only 30 per cent. increase when a complete manure was used.

This initial advantage was, however, not maintained and diminishes each year, until in 1904 the advantage is on the side of the plots with the complete manure which yielded 40 per cent. more than the unmanured, against a 30 per cent. increase in the case of the plots which received superphosphate only.

Orchard Notes.

W. J. ALLEN.

March.

On account of the rather backward season apples, which usually ripen and are fit to pull by the middle of February, will not be ready to pick this year until the beginning of March. In picking and storing the fruit, the utmost care should be taken in handling so as to avoid bruising it, else it cannot be expected to keep.

If intended for export, the fruit should be picked in the cool of the day or on cool days, and not allowed to stand in the sun, but should be kept in the shade of the tree until it is carted to the packing-house, and here also it should be kept as cool as possible until it is packed and ready for shipping; in fact, the secret of success lies in careful handling, honest packing, and keeping the fruit at as low a temperature as possible from the time it is taken from the tree until it reaches the consumer. Never by any chance should it be allowed to stand in the blazing sun at any time, nor to be over-ripe before being picked.

Generally when the seeds are well coloured it is ready to pick, and if properly stored will keep without shrivelling—that is, if they are keeping varieties. Apples keep best in cold storage at a temperature of 32 degrees Fahrenheit.

Green Manuring.—During this month black tares, gray field peas, or any other crop intended for green manure should be sown among the orchard trees. The earlier they are put in the better are the chances for a good crop, as it must be borne in mind that such a crop has to be ploughed under early in the spring in order that it may be well rotted before the dry weather sets in; also to prevent it absorbing moisture which should be conserved for the use of the tree. In sowing this crop, it always pays to sow with it about 80 lb. of superphosphates when the soil is in fair condition; but where the soil is poor, more than that quantity should be used. If any doubt should exist in the minds of growers as to whether or not it pays to apply manures to land sown to green crops, let such experiment, by omitting the manure from an occasional row, and the results will be so convincing that for the future no doubt will exist as to whether or not manure should be applied with the crops.

Red and other Scales on Citrus Trees.—If it is found that citrus trees are infested with scales, they should be fumigated as early as possible in order to cleanse the trees and fruit. The work should be done on a cool or cloudy day or at night-time. Avoid treating trees on hot days or in wet weather, and do not fumigate them if they have been sprayed with Bordeaux mixture at any time during the spring or summer, or the effect will be very disastrous

to the trees. If the grower is not in a position to fumigate, the spray pump should be brought into requisition, and the trees given two or three applications of resin, soda, and fish oil, or some other well-known remedy which can be applied at a reasonable cost. There is usually a good export market to be found in other States for clean, well-developed fruit, but they do not require any of our dirty inferior products.

At no time in the year can the result of different methods of pruning be seen so well as when the fruit is ripening, when each variety should be closely watched, and such notes taken thereon as will serve as a guide for the following year's pruning. It is always well to bear in mind that trees or vines must not be overloaded if they are expected to produce regular crops of high standard fruits, which quality alone will always command the highest prices on the market and best repay the grower, whilst taking the least out of the trees or vines.

The orchardist or farmer who intends planting a new orchard or extending those already established, should see that the land is prepared for the reception of the trees as soon as possible, as it is as well to have the land well broken up so that it may be exposed to the air and weather for some time prior to planting. The application of from half to one ton of lime to the acre would materially improve its condition, particularly on sour country, and the grower would find himself well recouped for the outlay by the extra growth which the trees would make.

The drying of apples, raisin grapes, sultanas, and prunes will, where these fruits are being grown, occupy the attention of the orchardist. After the apples are peeled and sliced they should be immersed for five minutes in a brine made as follows:—Dissolve 1 oz. of salt and dilute with 2 quarts of water, then spread the fruit on trays, and place in the sun or evaporator to dry. The prune and Gordo-Blanco grapes are, when ripe, immersed in a lye made as follows:—Dissolve by boiling 1 lb. of caustic soda in from 8 to 10 gallons of water, and in this dip the fruit for about one or two seconds, or just long enough to make minute cracks in the skins when the solution is just on the boil. In some districts the skins will be found tougher than in others, and therefore it will be necessary to test the fruit to find out for what length of time it will need to be immersed in order to slightly crack the skins. Over-dipping must be avoided, else the fruit when dried will be ragged, and in consequence would be classed as inferior. Before packing prunes they should be dipped in hot water for at least five minutes; then put out in the sun to dry thoroughly before packing in boxes. Those who are most successful in fruit-growing have found that they have had to combine a thorough system of cultivation with proper pruning and judicious manuring to attain these results. There is a time when each of these several branches of the work should be done, and by neglecting to properly attend to any one of them certain loss to the grower will inevitably follow.

Codlin moth should still be watched most carefully, and all grubs killed which have found shelter in the bandages. Also all fallen fruits should be picked up and destroyed. Budding young nursery stock may still be carried on during the early part of this month.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

Directions for the Month of March.

Vegetables.

The great heat of midsummer may diminish considerably during the month of March, and should rains occur generally throughout the State, the vegetable gardens, if well managed, should be very productive. At time of writing, the middle of February, rain is badly needed in many districts, and what with great heat and fires and dread of fires, but little vegetable growing has been attempted. But it would be desirable to look ahead for a more favourable season and not neglect the preparing of land in time for autumn planting and sowing, no matter how disheartening this work may seem to be, for as the season changes and a good time comes, so should, and will, the desire return to raise a crop of good fresh vegetables. Some little effort should be made, therefore, to be ready in good time, and, if possible, raise some plants of cabbage, cauliflower, &c., even though it may be a matter of considerable difficulty to do so. If such vegetables are ready and the ground is ready also, they can be planted out as soon as ever sufficient rain falls to saturate the ground.

The time is approaching when the broad bean may be sown; indeed, in the cool districts about the table-land, this vegetable may be sown with every chance of success about the middle of the month, and towards the end of the month it can be sown in the warmer districts. It is a good vegetable and deserves to be grown.

The watercress is a vegetable but seldom cultivated in the kitchen garden, although it is one that deserves attention. It grows wild in many places—in watercourses and swampy places—but this salad vegetable cannot be depended on for being sufficiently clean for use where dogs, sheep, or cattle may have access to it. It is not difficult to grow, even with a limited supply of water. The soil needs but to be kept moist with water and liquid manure, and it will grow luxuriantly. Quite a small patch, if well looked after, will yield a sufficient quantity of good succulent tops for the use of a family. This is quite a different thing to the cress that is generally associated with mustard. When planting cuttings of watercress, shade them well, and after they have made roots the shading can gradually be removed altogether. Towards the end of the month, herbs of all kinds may be planted, or, if these cannot be easily obtained, seeds may be sown. A good collection of herbs will be found very useful, and a sufficient quantity to supply all needs will take up but a small space in the garden. The value of herbs does not seem to be generally appreciated, judging from the limited number grown in country gardens. Perhaps some parsley, or, maybe, a plant or two of thyme, or a patch of mint or something of that kind, may be seen, but a collection is a rarity indeed.

Look ahead for the sowing of some onion seed, for although it would not be advisable to sow much seed during March, it may be sown extensively during April; therefore, some ground should be set apart and well prepared in the meantime. The onion is such a useful, and almost necessary, vegetable, that it should on no account be overlooked. It needs good, well-drained soil and good manure in order to grow well.

Asparagus.—It would be desirable to have the ground for the planting of this vegetable prepared in good time, for although planting need not be carried out before the early spring, the opportunity of a slack time should be taken to have everything ready, and save a rush at the last moment. The ground, which should be trenched, will then have time to settle down, and thus be in the best condition for planting.

Beans, French.—During dry seasons, beans, as well as peas, are liable to suffer from the attacks of red spider and thrips, and the leaves gradually turn yellow and fall off, and the plants cease to bear. When this is the case, the beans and peas should be pulled up and burnt, and the ground prepared for some other kind of vegetable. In the cool districts it would not be advisable to sow seeds, except in limited quantity, for there is no knowing when frosts may appear to cut them down. In the warm places along the coast, this bean may be sown as extensively as may be required.

Beans, Broad.—Towards the end of the month, a row or two may be sown, and ground prepared for a more extensive sowing next month. Dig the ground deep, and apply a good deal of manure. Lime, superphosphate of lime, or gypsum, will improve not only the growth but the quality of the beans.

Beet, Red.—Sow a row or two. As soon as the seedling beets have attained the height of 2 or 3 inches, thin them out well.

Beet, Silver.—Sow a little seed, either where the beets are to stand or for transplanting. The latter is the best method, and if adopted will save a great deal of seed. Make the soil rich with abundance of good manure.

Broccoli.—Sow seed in seedbed in drills for future use, and prick out seedlings from previous sowings which are large enough. Good sturdy plants available may be transplanted if weather conditions are favourable.

Cabbage, Cauliflower, Brussels Sprouts, and Savoy may be treated in the same manner as the broccoli. All the seedlings of these should be carefully transplanted, and afterwards efforts should be made to keep them growing without a stop, especially the cauliflowers and broccoli.

Celery.—A very little seed may be sown, for but few plants are likely to be required at a time. Any well-grown plants on hand may be transplanted to ground which has been specially prepared by very heavy manuring. A great deal of water will be required for celery should dry weather prevail. Celery plants which have nearly attained their full growth may be earthed up, or their stems blanched by any effective means the grower may please to adopt.

Cress and Mustard.—Sow a little seed to keep a supply going, and water well if the weather is dry.

Endive.—Sow a little seed and plant out seedlings already raised. Use abundance of manure, and grow the plants as speedily as possible, or else they will not be so tender and crisp, nor so well flavoured, than if they were allowed to grow slow.

Herbs.—These useful vegetables should receive the attention they deserve. Seed may be sown in seed-bed, boxes, or pots, where the seedlings can be carefully attended to when they come up. Plants available may be planted out whenever the weather is favourable. Large overgrown plants may be taken up, divided, and the best parts planted.

Leek.—This is good time of season to sow largely of seed. Sow in rows in seed-bed and transplant when the seedlings are 6 inches in height or even larger. The soil should be made very rich, and it should also be kept quite moist during the growth of the plants. The use of liquid manure pretty frequently is advisable.

Peas.—In the cool parts of the State seed may be sown if the weather is not over dry.

Radish.—Sow a little seed now and then to keep up a supply of young radishes for use.

Sea Kale.—Sow a little seed in seed-bed.

Spinach.—Sow seed in drills, about 18 inches apart, in good well-drained soil. As soon as the seedlings are large enough, thin out well.

Shallots and Garlic.—If cloves can be obtained, plant out in rows about 1 foot apart. The ground should be well dug and well manured before planting. Set the shallot and the garlic quite firm in the soil, and cultivate well between the rows as those plants grow.

Flowers.

Towards the end of the month, bulbs of many varieties may be planted either in clumps, which is the best way, or singly. Most of the spring-flowering bulbs will succeed well in nearly every part of the State wherever there is sufficient moisture for them. Some grow and flower best in cool climates, such as on the table-land and mountain ranges, particularly the tulips, hyacinths, crocuses, snowdrops, althongh some of them will succeed very well indeed in warmer and quite warm localities. Avoid ill-drained land for bulbs, and if not naturally well drained, take steps to ensure perfect drainage before planting. If the land is so poor that it needs manure, apply only old and well-rotted dung. All sorts of hardy annual seeds may be sown during the month, and in some districts the plants raised will flower in the very early spring or even during the winter. In other and later districts the flowers will appear in the spring. The seeds had better be sown in boxes, seed-pans, or pots, and as soon as possible the seedlings shouid be transplanted to a convenient place, and when large and strong enough to move should be transferred to the garden.

Towards the end of the month, cuttings of the ripened wood of those roses which it is desired to increase should be planted, and if kept moist they should strike root readily. Cuttings of fuchsias, pelargoniums, verbenas, and other herbaceous plants, should easily take root if planted during the month.

Farm Notes.

Hawkesbury District—March.

H. W. POTTS.

So far the prospects of a good autumn are remote, and we need rain to enable us to forecast a good maize harvest. In a number of instances on the uplands, the grain crops were checked through the abnormally high temperatures prevailing in the early part of last month, just as the early crops were cobbing. They were cut for ensilage. The later crops, however, were not injured, and, taking the crops as a whole, good returns may be expected. Some of the crops planted in the commencement of the season, on the river, will be ready to pull this month, and, in some places, operations have started. It will be wise to note the value of maize stalks at this stage as a fodder for dry stock in winter. The American system of shredding the stalks and converting them into stover is to be commended, in preference to the stupid practice in vogue of burning them. It seems strange to hear of a shortage of fodder for dry stock when so much is available from this source alone.

The *Sorghums*, this year, have come through the ordeal of early growth well, and promise splendid crops, both for green feed as well as ensilage

Lucerne.—This month may be selected to prepare the ground for this admirable fodder. It should be recognised that no fodder yet grown provides such satisfactory returns, and, if possible, a yearly sowing should be followed up. Where new land is taken in for this, some attention must be devoted to an examination of the physical as well as the fertile conditions. A deep, easily penetrable subsoil is almost an essential, drained well, with a good depth in which the roots of the plant may find moisture and plant food. It is realised that the soil need not be especially rich. Loamy soils, containing a good percentage of sand, encourage a sturdy growth. The great aim is to have the subsoil mechanically well stirred and loosened. The land is in the best condition after being cropped for some time, free from weeds, and will be still in better form if the preceding crop be a catch leguminous one, ploughed in as green manure. The surface soil should be in very fine tilth, and, further, be fertilised with a complete manure, including nitrogen in the form of dried blood. The finer the surface, with ample manure, the better the subsequent growth. Use from 15 to 20 lb. of clean seed per acre, and, in this connection, take care to purchase from reputable vendors, and secure healthy, well-matured seed, free from dodder. If there be a deficiency of lime in the soil, this can be rectified by augmenting the quantity of superphosphate in the mixed fertilisers.

Rape.—This quickly-growing fodder is becoming more popular as an excellent food for cattle, sheep, pigs, and poultry. It is succulent and relishable,

and, as to its feeding value, it may rank next to lucerne and clover. The great advantage in the rotation is the short time it occupies the land, and its known qualification, when grazed off, in restoring fertility to exhausted soils. As a feed for sheep and pigs the returns are highly satisfactory. Its value in the poultry pens has been fully demonstrated for laying hens. The question of broadcasting or drilling the seed is one that is best determined by the available moisture. Where it is ample, then broadcasting will give the best returns. Should the weather prove unusually dry, then drilling, 2 feet apart, may be adopted. A full feeding crop may be expected in from twelve to fourteen weeks. Sow 4 to 5 lb. per acre of the Dwarf Essex variety. It will grow best in moist, loamy soils, with a preponderance of sand. Black soils rich in humus encourage a luxuriant growth. For fertilising purposes farmyard manure acts well; failing this, then the following mixture may be applied, at the rate of 2 cwt. to the acre:—

Nitrate of soda	37 parts.
Blood (dried)	33 ,,
Superphosphate	180 ,,
Sulphate of potash	60 ,,

See that the seed is sown on a firm, moist, fine seed-bed, and well rolled afterwards. Light harrowing may be adopted when the plant is well advanced. Rape may follow a maize crop as a green manuring crop or catch-crop for stock. The deep-penetrating root system of the plant aids in raising to the surface soils phosphoric acid and potash from the subsoils; it practically carries out the functions of a subsoiler by opening it and penetrating it. The stock return manure in a rich form; and when roots and manure from the stock are ploughed in, the soil is brought into a fertile state for cereals.

Cowpeas.—Each year's returns from this important addition to our fodder plants adds increasing evidence of their value as a stock food and soil renovator. During the past two months, horses, sheep, and cattle have been fed on this rich, green, and succulent fodder.

Cereal Crops.—It will be necessary to get the soil in order for the early sowings whilst the ground is warm, towards the end of the month. The macaroni wheats are better sown this month, in order to provide a crop of green feed for midwinter. Blount's Lambrigg gives a wealthy cut of green fodder.

Oats.—Seeing this crop has a great demand on the moisture contents of the soil, it is well to see that damp situations are selected. Algerian oats may be sown this month, even though the soil be dry. When sown, it is ready for the earliest fall. We find this variety provides the best hay, and is practically free from rust.

For midwinter green feed the *Macaroni Wheats* may be sown.

Barley.—On good land along the coastal areas a crop of barley may be sown. The skinless sort is the earliest for green forage, and gives a good yield. A second crop may be cut later on in the winter. The weight per acre can be considerably increased by adding tares.

Riverina District—March.

G. M. McKEOWN.

Wheat for Hay.—As March and April are the best months for sowing wheat for hay in this and similar districts, the work of sowing should be pushed forward without delay. The dry conditions and high temperature of the last few months will have made the work difficult in some soils in which fallowing has not been carried out. For stubbles or other unbroken land, the rotary disc plough will be found an invaluable dry-weather implement. There are various designs of these implements now on the market, which will prepare an excellent seed-bed with the greatest speed and economy, the pulverisation of the soil and the depth of the work being excellent. The land should be ploughed as deep as the nature of the soil will admit. Forty-five pounds of plump seed will be found ample under local conditions. Zealand or Berthoud, White Essex, White Lammas, and Australian Talavera, will be found among the best kinds, as the white varieties make hay of far better appearance than that of the purple straws. It also weighs better, and is better liked by stock.

Of the purple straws, Marshall's No. 3 makes about the best hay, provided it is cut while quite green. From 73 acres of Zealand recently cut for hay on the Wagga Experimental Farm, we harvested 233 tons, the whole having been checked over the weighbridge. A second block of 100 acres returned about 300 tons, measured on the basis of the weighbridge results.

Wheat for Grain.—April and May are our best months for sowing, therefore preparations should be pushed forward so as to prevent late sowing.

Oats.—March is the best month for sowing, while April also is safe. Not more than a bushel of seed per acre should be sown in the dry districts, and sowing by drill will be found advantageous. Algerian Dun and Rust-proof are excellent varieties both for dry or rusty districts, as they can be relied on to yield good crops of hay of first-class quality. Following are the yields of grain recently harvested from trial areas of half-an-acre to an acre in extent. Seed was sown at the rate of half a bushel per acre, and all varieties were manured with superphosphate.

	Per acre. bus.	lb.		Per acre. bus.	lb.
Big Four	75	22	Rust-proof	54	30
White Ligowo	74	5	Storm King	47	7
Abundance	66	9	Tartar King	46	34
Silver-mine	65	22	Algerian	44	28
Danish Island	62	32	Skinless	41	5
Goldfinder	59	39	Colossal	39	34
Great Northern	59	24			

With the exception of Algerian, Rust-proof, and Skinless, seed of the above varieties is obtainable at the Farm.

Rape.—Should be sown in March, if possible. The land should be brought into as fine a condition as possible, by harrowing and rolling after ploughing.

The seed may be sown broadcast, at the rate of 3 lb. per acre; and, as it is small, the surface of the land should be made as even as possible. It should be lightly covered by harrowing. Dwarf Essex is the best variety.

Vegetables.—Swedes may be sown if there is sufficient moisture. White turnips should also be sown. Sow cabbage and cauliflower in beds, for later transplantation, where shade and water can be applied if necessary. Broad beans and a few peas may be sown.

Glen Innes District—March.

R. H. GENNYS.

Get land ready for early wheats. Procure good seed to sow in this connection. I will quote such an authority as Dr. Cobb, who states:—"The advantages of large, plump, graded seed are that: It is likely to be healthier seed, and therefore more likely to produce healthy plants. It can be sown more evenly on account of its uniform size. There is a larger percentage of growth and fewer failures. The plants from such seeds are larger and thriftier, and more resistant to disease, drought, and starvation. The crops from such seed have a more even growth, and are more economical to harvest and thresh. The yield per plant, both of grain and straw, is greater from such seed. The crop of grain grown from such seed has a higher market value, because—

"(*a*) It contains more large grains and fewer small grains.

"(*b*) It is plumper and better looking.

"(*c*) It weighs more per bushel.

"The continuous use of such seed tends towards a general improvement in the quality of wheat."

Rape may be sown for feeding stock in winter. Dwarf Essex, a favourite variety, about 6 lb. per acre is sufficient to sow.

Barley may be sown for green feed. Cape or Skinless, two of the best, may be sown with tares or vetches if required.

Rye may also be sown with tares for green food or for hay if cut early.

Clovers for feed or hay may be planted end of the month.

Field Peas may be sown alone or in conjunction with barley or rye.

Lucerne.—The latter part of March is a good time to sow lucerne to enable roots to establish themselves well into the soil before cold weather sets in. The seed should be bright, and of a yellow colour; if too dark a shade, it is not a good sign. Sow from 12 to 15 lb. of good seed. Plough deeply and prepare seed-bed thoroughly; and most important of all, see that the land is clear of weeds. Choose deep rich alluvial soil where possible, with an open subsoil. Where the land is clayey, see that it is well drained; but, if possible, avoid cold stiff subsoils.

Bathurst District—March.

R. W. PEACOCK.

Wheat.—Upon the Bathurst Farm the past season has again demonstrated the many advantages to be derived from a system of mixed farming and rotation of crops. With a rainfall of only 18·57 inches for the year, following upon a similarly low rainfall of 1904 of only 18·26 inches, as high as $37\frac{1}{2}$ bushels of Federation wheat were grown to the acre upon one of the poorest paddocks of the farm, it having been cropped with rape and depastured by sheep during 1904. It was surprising how the grain filled, considering the dry weather of November and December, and proved that the moisture-holding capacity of the soil had been considerably increased by ploughing under the residue of the rape crop and the excrement of the sheep. The crops throughout the farm were good, especially the early ones, and I would again impress upon farmers the necessity of preparing the land early for the wheat crops. It is often the case that the profits of the early sown crops are swamped by the losses of the late ones, and it would have been better if the farmer had not attempted the late sowings, which he considered might turn out all right. Comparatively early sowings invariably ensure satisfactory crops. They also ensure good healthy root development, and such prevents the soil getting out of condition so readily by subsequent winter rains. Owing to the ground being warmer early in the sowing season, the percentage of germination is often higher and more satisfactory, other things being equal. Less seed is required when sown early. The crop also gets ahead of the weeds, which is of considerable importance upon weedy land. Every effort should be taken to conserve moisture by cultivation, &c., for the germinating period. It must be borne in mind that some of the quick-growing wheats can be sown so early that they are liable to be frosted during the winter and spring. In my opinion, April and May are the two best months to sow wheat. It is preferable to get a smaller area in seasonably, than a larger area, a large proportion of which is out of season. Good crops pay the farmer, the light ones rarely, if ever, do. Some of the long-season wheats, such as White Lammas, Tuscans, &c., may be sown the latter part of the month, to be grazed during the winter by sheep. If the stocking is done rationally, a creditable yield of grain may be expected. It is not advisable to feed off later than July. A sowing of some early maturing variety could be made early in the month for winter fodder.

Barleys.—These should be sown early in the month for green winter fodder. The Cape and Skinless varieties are suitable for this purpose. The Skinless is earlier than the Cape, but does not stand the winter as well, and the second growth is not so satisfactory. They require the soil to be in good heart, with a fair quantity of available plant-food near the surface.

Rye.—Sowings should be made early in the month for green fodder. It possesses the advantage over other cereals of producing fair yields from

poorer soils, and also with standing greater degrees of cold. It is valuable for poor soils. The Black Winter and Arctic varieties are the best for early winter green fodder.

Tares and Field Peas.—These can be sown for fodder or green manuring during the month. When sown in conjunction with the foregoing cereals, they add materially to the quality of the fodder. The Black Tare and the Grey Field Pea are two of the best for these purposes. To add nitrogen to the soil, these and allied plants cannot be neglected in rotation.

Rape.—Should be sown early in the month. It requires well-prepared land; is a rapid grower, of excellent fodder value, especially for ewes and lambs. It is a moderately deep rooter, and withstands a fair amount of dry weather, and is valuable in a rotation. The Dwarf Essex variety is the best.

Lucerne.—This plant deserves special attention, it being one of the most nutritious and prolific of fodder plants. Its long tap-roots enable it to throw out green leaves during dry summers, when many other plants of the pastures are brown. It should be sown towards the end of the month, if the weather is favourable, upon deeply worked well-prepared soil. As it occupies the land for several years, good thorough cultivation is well repaid by the better stand and more substantial yields, than are obtained by the more slipshod methods. It is better sown without a shelter crop, it doing much better alone, and should be sown early in order to establish itself before the dry weather of the ensuing summer. It thrives best upon rich alluvial soils unbroken by any stratum of coarse sand or gravel. Upon the lighter soils it produces a fair amount of fodder, and will last for several years without replanting. It is valuable in a rotation both as a nitrogen gatherer and subsoiler.

Grasses and Clovers.—Many perennial grasses and clovers should be sown during this month upon well-prepared land. When sown during the autumn they establish themselves, and are the better able to withstand the dry summers which are the rule. Barley Grass and Barren Fescue (or Silky Grass), which appear so profusely as weeds, interfere considerably with the successful cultivation of many of the grasses. The dry summers are very trying in this district for all the clovers.

The growing crops, such as swedes, kale, &c., will require cultivation and keeping free from weeds. The early maize may be ripe enough to harvest, and the stalks should be cut before perishing, and stood on either side of a fence or better place, to be afterwards fed to stock in the cold weather. By so treating, their nutriment is retained longer, and are acceptable to stock.

Crown Lands of New South Wales.

The following areas will be available for selection on and after the dates mentioned:—

For Original Conditional Purchase.

Land District.	Name of Holding, &c.	Total Area.	Parish.	County.	Price per Acre.	Date available
		a. r. p.			£ s. d.	1906.
*Cootamundra.	Within Cootamundra Population Area.	93 2 0	Cootamundra ..	Harden ..	2 0 0	5 Apr.
*Forbes ..	Within Forbes Population Area.	80 0 0	Wongajong ..	Forbes	3 0 0	8 Mar.
Gosford ..	....	40 0 0	Pofran	Northumberland	1 0 0	8 ,,
*Grafton ..	Within Iluka Population Area	897 0 0	Yamba	Clarence ..	1 5 0 and 1 15 0	12 Apr.
*Gunnedah ..	Within Gunnedah Population Area	316 1 10	Gunnedah	Pottinger ..	2 10 0 to 4 0 0	29 Mar.
Muswellbrook.	....	52 0 0	Baerami	Hunter ..	1 10 0	26 Apr.
*Picton ..	Within Wilton Population Area	473 3 0	Bargo	Camden ..	1 10 0	29 Mar.

* Identical with Special Area.

For Original Conditional Purchase or Conditional Lease.

Land District.	Name of Holding, &c.	Total Area.	Parish.	County.	Price per Acre.	Date available
Coonabarrabran	On Yerrinan Holding.	138 2 0	Wheoh .. .	Baradine ..	1 10 0	15 Mar.
Eden ..	....	130 0 0	Cobra .. .	Auckland ..	2 0 0	26 Apr.
Eden ..	....	45 0 0	Gnupa ..	,, .	3 10 0	26 ,,
Mudgee ..	....	4,100 0 0	Hargraves ..	Wellington ..	0 18 4	26 ,,
Narrandera ..	On Berry Jerry and Arajoel Holdings	751 3 0	Mimosa .. .	Mitchell ..	1 5 0	26 ,,
Tenterfield ..	On Deepwater Holding.	236 1 0	Romney .. .	Clive ..	1 5 0	5 ,,

For Ordinary Conditional Purchase or Conditional Lease.

Land District.	Name of Holding, &c.	Total Area.	Parish.	County.	Price per Acre.	Date available
Bellingen	....	200 0 0	Ketelghay . ..	Raleigh ..	1 0 0	26 Apr.
Casino .	....	100 0 0	Woram .. .	Richmond .	1 0 0	12 ,,
Eden .	....	280 0 0	Gnupa and Cobra..	Auckland ..	1 0 0	26 ,,
Grafton	.... ..	40 0 0	Ashby .. .	Clarence ..	1 0 0	5 ,,
Gundagai	On Cotway Holding	162 3 0	Gobbarralong	Buccleuch	1 0 0	5 ,,

H.S. No.	Name of Land District.	Holding, &c.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
	For Homestead Selection.							
					acres.		£ s. d.	1906.
*994	Windsor ..	....	....	1	39½	7½ miles from Windsor, *via* Wilberforce.	0 12 4	8 Mar.
S.L.	**For Settlement Lease.**							
*827	Warren ..	Buckinguy..	....	1	6,680 (approx., subject to alteration on survey).	40 miles from Girilambone.	63 11 8	15 Mar.

* Original applications only.

Special Area.

Cootamundra Land District, within the Cootamundra Population Area, 93½ acres; maximum and minimum area, 93½ acres; distant 2 miles from Cootamundra; price, £2 per acre. Available for original applications only on 5th April, 1906.

Forbes Land District, within the Forbes Population Area, 80 acres; maximum and minimum area, 80 acres; distant 4 to 6 miles from Forbes; price, £3 per acre. Available for original applications only on 8th March, 1906.

Grafton Land District, within Iluka Population Area, 897 acres, in parish Yamba, county Clarence; maximum area, 56¼ acres; minimum area, 34¼ acres; distant 1½ to 2 miles from Yamba; price, £1 5s. and £1 15s. per acre. Available for original applications only on 12th April, 1906.

Gunnedah Land District, within the Gunnedah Population Area, 316 acres 1 rood 10 perches, in parish Gunnedah, county Pottinger, maximum area 57 acres; minimum area, 13 acres 1 rood 30 perches; price, £2 10s. to £4 per acre. Available for original applications only on 29th March, 1906.

Picton Land District, within the Wilton Population Area, 473¾ acres, in parish Bargo, county Camden maximum area, 86½ acres; minimum area, 40 acres; price, £1 10s. per acre. Available for origina applications only on 29th March, 1906.

AGRICULTURAL SOCIETIES' SHOWS.

1906.

Society.	Secretary.	Date.
Gunning P., A., and H. Society	Ernest E. Morgan	Mar. 1, 2
Robertson A. and H. Society	R. G. Ferguson ...	,, 1, 2
Campbelltown A., H., and I. Society	A. R. Payten ...	,, 6, 7
Tenterfield Intercolonial P., A., and Mining Association	F. W. Hoskin ...	,, 6, 7, 8
Bega A., P., and H. Society	John Underhill ...	,, 7, 8
Walcha P. and A. Association	S. Hargrave ...	,, 7, 8
Canowindra P., A., and H. Association	John J. Finn ...	,, 7, 8
Macleay A., H., and I. Association	E. Weeks... ...	,, 7, 8, 9
Fair days	....	,, 9, 10
Narrabri P., A., and H. Association	J. McCutcheon ..	,, 7, 8, 9
Nepean District A., H., and I. Society, Penrith ...	E. K. Waldron ...	,, 8, 9
Berrima A., H., and I. Association (Moss Vale) ...	James Yeo ...	,, 8, 9, 10
Bombala Exhibition Society	W. G. Tweedie ...	,, 13, 14
Cumnock I., A., and H. Association	W. L. Ross ...	,, 14
The P. and A. Association of Central New England, Glen Innes	Geo. A. Priest ...	,, 13, 14, 15
Clarence P. and A. Society, Grafton	T. T. Bawden ...	,, 14, 15
Camden A., H., and I. Association	A. Thompson ...	,, 14, 15, 16
Oberon A., H., and P. Association	W. Minehan ...	,, 15, 16
Newcastle and District A., H., and I. Association ...	Owen Gilbert ...	,, 15, 16, 17
Goulburn A., P., and H. Society	J. J. Roberts ...	,, 15, 16, 17
Lower Clarence Agricultural Society, Maclean ...	George Davis ...	,, 20, 21
Cobargo A., P., and H. Society	T. Kennedy ...	,, 21, 22
Gundagai P. and A. Society	A. Elworthy ...	,, 21, 22
Blayney A. and P. Association	H. R. Woolley ...	,, 21, 23
Manning River A. and H. Association	S. Whitehead ...	,, 22, 23
Crookwell A., P., and H. Association	C. T. Clifton ...	,, 22, 23
Molong P. and A. Association	C. J. V. Leathem	,, 28
Durham A. and H. Association, Dungog	C. E. Grant ...	,, 28, 29
Mudgee Agricultural Society	J. M. Cox... ...	,, 28, 29, 3
Cooma P. and A. Association	C. J. Walmsley ...	April 4, 5
Bathurst A., H., and P. Association	W. G. Thompson	,, 4, 5, 6
Warialda P. and H. Association	W. B. Geddes ...	,, 4, 5, 6
Richmond River A., H., and P. Association (Casino)	E. J. Robinson ...	,, 5, 6
Royal Agricultural Society of New South Wales ...	H. M. Somer ..	,, 11 to 19
Hunter River A. and H. Association (West Maitland)	C. J. H. King ...	,, 24, 25, 26, 27, 28
Orange A. and P. Association	W. Tanner ...	,, 25, 26, 27
Wellington P. A., and H. Society	A. E. Rotton ...	May 1, 2, 3
Upper Manning A. and H. Association	Edw. Rye... ...	,, 3, 4
Moree P. and A. Society...	S. L. Cohen ...	July 8, 9, 10
Hay P. and A. Association	G. S. Camden ...	,, 26, 27
National A. and I. Association of Queensland ...	.. ..	Aug. 7, 8, 9, 10, 11
Murrumbidgee P. and A.	A. F. D. White ...	,, 22, 23
Cootamundra A., P., and H.	T. Williams ...	,, 28, 29
Gunnedah Show	J. H. King ...	,, 28, 29, 30
Junee P., A., and I. Association	T. C. Humphrys...	Sept. 5, 6
Albury and Border P., A., and H. Society	W. J. Johnson ...	,, 11, 12, 13
Young P. and A. Association	Geo. S. Whiteman	,, 12, 13
Temora P., A., H., and I.	W. H. Tubman ...	,, 25, 26
Yass P. and A. Society	W. Thomson ...	,, 26, 27

[Two Plates.]

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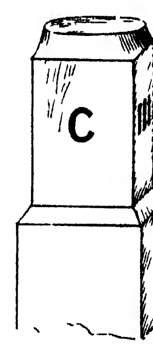
Field-experiments with Wheat at the Cowra Experiment-station Farm.

W. FARRER AND G. L. SUTTON.

OUR wheat-growers have now reached the stage at which they recognise that certain problems connected with their industry must be solved, and that what is wanted most of all, is that its processes be made to cease to be only matters of opinion, and be placed upon the more certain and satisfactory basis of ascertained facts. An earnest endeavour is now being made to lay hold of some of these problems, and experiments have been planned for the purpose of exhibiting, by means of practice, the principles on which the methods we follow are founded. It is possible that these experiments may also point to modifications of our present methods, which the peculiarities of our climate cause to be desirable. While every effort has been made to have the experiments thorough, no pains have been spared to make them simple, and to prevent them from being involved. The area at the Cowra farm which devoted to experiments includes the best portions of a block of 200 acres, which has been cleared for cultivation. The whole of the land is typical of the larger part of the wheat-land in the surrounding district, and, as regards aspect, is favourably situated. It lies on the side of an undulating slope which faces the east and north-east. Portions of this 200 acres are too steep, and otherwise unsuitable for experimental work; but these have been utilised for the needs of the farm. All the land which is suitable for experiment work has been divided into plots, the boundaries of which have been permanently defined by stout posts. There will, therefore, be no difficulty in the future in tracing the history of any of the plots from the records, and by means of the plan on which the respective plots are numbered in the same manner as they are on the posts. Each plot, although unfenced, is in reality a miniature paddock; and, although the tillage operations must be as thorough and systematic as it is possible for us to make them for the results to be reliable, yet in order that they may be of real value to the practical farmer, we have been just as careful to carry out the details of preparing and planting each plot in exactly the same manner as a good and progressive farmer would make use of in preparing a paddock of his farm for a similar crop.



Post used to permanently mark experiment plots.

The character of the soil of the plots varies from a light red granitic loam on the higher land, to a grey pipeclay loam, somewhat stubborn in texture, on the lower lands. The change from one class of soil to the other is, fortunately, very gradual and in no place sudden. As the ground had only been recently

cleared, and had carried an uneven growth of timber up to a few months before the crops were planted, the results which are presented in this paper can hardly be considered to be so valuable as will be those which are obtained after the ground has become more even by similarity of treatment. No pains will be spared to make it as even as possible.

Character of the Season.

On the whole, the season was remarkable most for its lateness, and especially in the respect that the summer was late in setting in. Previous to early in April, when the autumn rains set in, the weather had been dry. In the late autumn and early winter, the abundant rains and absence of severe frosts made the weather to be exceedingly favourable for the growth of vegetation ; but the wetness of the soil caused much of the planting to be done under unfavourable conditions. The winter was a mild one, but the spring set in late, and, up to the middle of November, was decidedly colder than usual. The change from spring weather to summer came about the middle of November, and was very sudden, and with the summer came unusually severe heat and a drought. The conditions on the whole were favourable to the early and mid-season-sown crops, and, probably, somewhat more than usually unfavourable to the late-sown. The rainfall which would influence the wheat crops, as furnished by the records taken on the farm, was as follows :—

COWRA EXPERIMENTAL FARM.

RAINFALL recorded during the wheat season, 1905.

Month	Day	Points	Total
March	28	30	
	29	8	
			38
April	3	122	
	4	28	
	5	66	
	6	144	
	10	6	
	11	47	
	12	29	
	13	10	
	14	33	
	25	15	
	26	13	
	27	31	
			544
May	3	15	
	5	12	
	9	44	
	26	7	
	27	37	
	28	27	
	29	14	
	30	14	
	31	2	
			172
June	1	4	
	2	20	
	3	5	
	6	1	
	7	37	
	12	1	
June	13	6	
	14	17	
	17	4	
	19	2	
	22	72	
	23	97	
	29	5	
	30	6	
			277
July	1	28	
	2	1	
	3	1	
	4	2	
	9	38	
	10	74	
	11	4	
	12	61	
	14	1	
	24	3	
	25	1	
	26	27	
	30	28	
			269
Aug.	7	1	
	8	35	
	21	3	
	27	98	
	29	2	
	30	18	
	31	3	
			160
Sept.	6	16	
Sept.	7	1	
	10	12	
	11	12	
	14	1	
	15	2	
	16	12	
	17	1	
	19	70	
	25	13	
	26	3	
			143
Oct.	1	1	
	7	31	
	11	8	
	12	23	
	14	4	
	15	38	
	17	40	
	18	25	
	23	85	
	24	16	
	28	5	
	29	22	
	31	47	
			347
Nov.	1	8	
	10	2	
	18	1	
	19	1	
	28	3	
			15
Dec.	1	9	9

Total—19 inches 74 points.

Experiment I.

Seeding Experiments.

The object of this experiment is to determine—

(*a*) The most suitable period of the season for planting the seed.

(*b*) The most economical amount of seed to use when the crop is planted at different periods of the planting season, viz.: (1) early, (2) midseason, and (3) late.

(*c*) Whether the direct application of a simple or a mixed fertiliser is beneficial when the supply of organic matter in the soil is maintained in accordance with the practice which is at present regarded as the best for the district.

In order to obtain results which are not likely to be affected by peculiarities of the variety, this experiment was conducted in detail with three kinds of wheat. The sorts which, for this season, were chosen, were—

"Federation"; an early variety.

"John Brown"; a later variety.

"F (R 1)"; a Russian macaroni variety which considerably resembles Beloturka, and at one time was thought to be that variety, and last season was distributed under that name.

The accompanying plan of one section will show the manner in which the plots were arranged in carrying out the experiment.

Each portion, which was planted with the specified quantities of seed, was subdivided, as shown in fig. 2, into ten plots, which were manured as follows:—

Plot 1	received	no fertiliser.			
2	,,	Sulphate of ammonia,	at the rate of	60	lb. per acre.
		Superphosphate	,,	90	,,
3	,,	Superphosphate	,,	90	,,
4	,,	Sulphate of potash	,,	30	,,
5	,,	No fertiliser.			
6	,,	Sulphate of ammonia	,,	60	,,
7	,,	Sulphate of ammonia	,,	60	,,
		Sulphate of potash	,,	30	,,
8	,,	Superphosphate	,,	90	,,
		Sulphate of potash	,,	30	,,
9	,,	Sulphate of ammonia	,,	60	,,
		Superphosphate	,,	90	,,
		Sulphate of potash	,,	30	,,
10	,,	No fertiliser.			

In this experiment each plot consists of an area 16 links wide by 326·6 links long (about $\frac{1}{20}$ acre), and is planted the full width of a 15-disc grain-drill, which was driven down the centre of the plot, thus leaving a space of about 3 links wide between each two adjacent plots as a division between them. In order to facilitate the harvesting, strips 9 links wide were left

between adjacent groups of ten plots planted with the same quantity of seed. Headlands 40 links wide separated the different varieties from each other.

It had been arranged to plant each section as follows:—**Early planting,** 23rd March to 7th April; **midseason planting,** 1st May to 14th May; **late planting,** 7th June to 20th June; in each case a margin of fourteen days being allowed, to afford that elasticity which is always necessary when plans for agricultural operations are being made. Owing to unavoidable causes, incidental to the establishment of a new farm, this programme could not be adhered to, and the early planting did not take place until 19th April, the midseason until 25th May, and the late until 27th June.

Taking into consideration the general custom of seeding on farms, 20, 40, and 60 lb. were chosen as representing **thin, medium,** and **thick** seeding respectively. Owing to the differences in the size and weight of the seeds of different varieties, it is impossible to adhere strictly to these amounts; but approximately these were the quantities sown, and in no case did the amount vary more than 2 lb. per acre from the quantity decided upon.

General View of Experiment I.

Preparation of the Soil.

Owing to the recent establishment of the farm and the very dry summer, the condition of the soil was not as satisfactory as was desired. In consequence of this, we had considerable trouble from weed-growth. This trouble was increased very considerably by the moist autumn and mild winter. The ground was ploughed, harrowed, and disced, and, lastly, clod-crushed just

prior to planting. The land for the midseason planting was, if anything, the most evenly and satisfactorily prepared.

Planting.

The method which was adopted was to apply the fertilisers to the plots shortly before planting the seed. By making up the quantity of fertiliser required for each plot to the same predetermined bulk by admixture with sand, the fertilisers were distributed quickly and with great evenness by means of the grain-drill. As the capacity of the drill for each kind of seed had been ascertained by actual trial, no difficulty was experienced in setting the drill to sow very closely the amount of seed desired.

Harvesting—Cowra Experiment-station Farm, 1905.

Harvesting.

Before harvesting, the area of the portion of each plot which was to be used for the comparisons was reduced to $\frac{1}{30}$ of an acre, by removing portions from each end of the blocks of plots. The centre portions which remained were in this way made to be free from disturbing outside influences.

The harvesting was done with a stripper, which this season proved exceedingly expeditious and very suitable for this work. The grain was cleaned directly from the stripper, and weighed as it left the winnower. The weights recorded are, therefore, those of a farmer's sample.

From the results thus obtained the following tables have been compiled. The yields per acre have been computed from the actual yields of the plots.

TABLE I.—FIRST SECTION.

Seed planted April 19, 1905.

Plot No.		Rate of Seeding—20 lb. per Acre.				Difference apparently due to the use of Fertiliser.
		Yield per Acre (computed).			Average three Varieties.	
		Federation.	F (R1).	John Brown.		
		bush.	bush.	The results from this variety, owing to earlier planting and other causes, cannot be utilised in this trial.	bush.	bush.
C. III 1	No manure	29·0	18·2		25·2	....
2	Sulphate of ammonia 60 lb. / Superphosphate 90 lb.	25·3	20·5		22·9	− 2·3
3	Superphosphate 90 lb	22·5	16·2		19·3	− 5·9
4	Sulphate of potash 30 lb.	30·2	23·2		26·7	+ 1·5
5	No manure	31·8	23·8		25·2	.....
6	Sulphate of ammonia 60 lb	28·5	21·0		24·7	− 0·5
7	Sulphate of ammonia 60 lb. / Sulphate of potash 30 lb.	26·1	17·8		21·9	− 3·3
8	Superphosphate 90 lb. / Sulphate of potash 30 lb.	24·7	21·8		23·2	− 2·0
9	Sulphate of ammonia 60 lb / Superphosphate 90 lb. / Sulphate of potash 30 lb.	36·0	21·0		23·5	− 1·7
10	No manure	25 2	23·6		25·2	....
	Average yield of varieties with different seedings	26·0	20·7			

TABLE II.—SECOND SECTION.

Seed Planted, May 25, 1905.

Plot No.		Federation.	F (R1).	John Brown.	Average three Varieties.	Difference apparently due to the use of Fertiliser.
		bush.	bush.	bush.	bush.	bush.
C II 1	No manure	35·7	19·0	24·5	25·0	.....
2	Sulphate of ammonia 60 lb. / Superphosphate 90 lb.	34·7	18·3	25·7	26·2	+ 1·2
3	Superphosphate 90 lb.	33·2	19·1	25·2	25 8	+ 0·8
4	Sulphate of potash 30 lb.	30·5	21·0	24 6	25·3	+ 0·3
5	No manure	28·2	18·2	24·7	25·0	....
6	Sulphate of ammonia 60 lb.	28·5	18·0	25·5	24·0	− 1·0
7	Sulphate of ammonia 60 lb / Sulphate of potash 30 lb.	28·0	17·3	28 7	24·6	− 0·4
8	Superphosphate 90 lb. / Sulphate of potash 30 lb.	22 7	13·5	27 0	21·0	− 4·0
9	Sulphate of ammonia 60 lb. / Superphosphate 90 lb / Sulphate of potash 30 lb	30·2	12·0	27·2	23 1	− 1·9
10	No manure	31·7	15·2	28·3	25·0	...
	Average yield of varieties with different seedings	30 3	17·1	26 1	... .	...

TABLE III.—THIRD SECTION.

Seed Planted, June 27, 1905.

Plot No.		Federation.	F (R1).	John Brown.	Average three Varieties.	Difference apparently due to the use of Fertiliser.
		bush.	bush.	bush.	bush.	bush.
C I 1	No manure	20 3	14·2	15·0	14·4	.....
2	Sulphate of ammonia 60 lb. / Superphosphate 90 lb.	11 7*	12·2*	12·0*	11·9	−2·5
3	Superphosphate 90 lb.	15·1	15·2	15·0	15·1	+0 7
4	Sulphate of potash 30 lb.	15·6	15·3	17·0	15·9	+1·5
5	No manure	15·0	15·1	14·5	14·4	.....
6	Sulphate of ammonia 60 lb.	14·5	13·7	14·7	14·3	−0 1
7	Sulphate of ammonia 60 lb. / Sulphate of potash 30 lb.	14·6	12·0	13·8	13·4	−1·0
8	Superphosphate 90 lb. / Sulphate of potash 30 lb.	15·2	13·1	14 6	14 3	−0·1
9	Sulphate of ammonia 60 lb. / Superphosphate 90 lb. / Sulphate of potash 30 lb.	13·1	13·5	14·5	13·7	−0·7
10	No manure	11·0	11·8	13·3	14 4	.....
	Average yield of varieties with different seedings	14·6	13·6	14·4	.. ...	......

* Very thin; in a low, cold place.

EARLY PLANTING.

Crops harvested—Federation, Dec. 15, 1905; F. (R 1), Dec. 19, 1905; John Brown, Dec. 19, 1905.

Rate of Seeding—40 lb. per Acre.					Rate of Seeding—60 lb per Acre.				
Yield per Acre (computed).			Average three Varieties.	Difference apparently due to the use of Fertiliser.	Yield per Acre (computed).			Average three Varieties.	Difference apparently due to the use of Fertiliser.
Federation.	F (R1).	John Brown.			Federation.	F (R1).	John Brown		
bush.	bush.	bush.	bush.		bush.	bush.	bush.	bush.	bush.
27·7	24·1	17·2	19·6	....	19·8	17·5	20·2	19·9	....
22·7	19·0	18·3	20·0	+ 0·4	21·8	18·2	19·5	19·8	− 0·1
21·2	22·5	18·7	20·8	+ 1·2	21·0	19·7	18·2	19·6	− 0·3
......	18·1	12·2	15·1	− 4·5	25·5	23·3	18·6	22·4	+ 2·5
22·1	12·1	14·6	19·6	....	27·0	21·7	20·7	19·9	....
17·8	11·1	8·8	12·5	− 7·1	22·5	20·2	16·2	19·6	− 0·3
21·1	13·7	15·3	16·7	− 2·9	26·0	18·5	17·3	20·6	+ 0·7
18·7	15·3	16·6	16·8	− 2·8	25·3	20·0	17·7	21·0	+ 1·1
23·5	15·6	18·6	19·2	− 0·4	18·6	20·7	11·5	16·9	− 3·0
26·5	13·2	19·7	19·6	....	20·8	21·6	10·5	19·9	
22·3	16·4	16·0			22·8	20·1	17·0		

MIDSEASON PLANTING.

Crop Harvested—Federation, Dec. 21, 1905; F (R 1), Dec. 30, 1905; John Brown, Dec. 20, 1905.

bush.	bush.	bush.	bush.	bush.	bush.	bush.	bush.	bush.	bush.
31·5	19·0	34·0	28·5	......	28·0	15·0	22·2	28·1	......
38·5	20·0	34·6	31·0	+ 2·5	44·2	24·5	32·5	33·7	+ 5·6
34·0	18·5	33·0	28·5	+ 0·0	44·0	21·0	32·6	32·5	+ 4·4
33·0	16·1	33·0	27·3	− 1·2	42·2	27·5	34·6	34·8	+ 6·3
33·0	17·0	29·2	28·5	......	40·2	23·0	32·2	28·1	......
29·5	20·2	31·5	27·0	− 1·5	37·8	21·5	34·7	31·3	+ 3·2
28·7	16·2	27·8	24·2	− 4·3	40·2	25·5	35·2	33·6	+ 5·5
33·7	21·8	24·7	26·7	− 1·8	39·8	23·0	30·5	31·1	+ 3·0
33·5	20·5	29·8	27·9	− 0·6	37·0	24·7	30·0	30·6	+ 2·5
34·0	23·2	35·6	28·5	....	37·0	23·2	32·3	28·1	......
32·9	19·2	31·3	....	...	39·0	22·8	31·7	...	......

LATE PLANTING.

Crops Harvested—Federation, Dec. 28, 1905; F (R 1), Dec. 29, 1905; John Brown, Dec. 29, 1905.

bush.	bush.	bush.	bush.	bush.	bush.	bush.	bush.	bush.	bush.
11·8	13·7	12·5	14·1	.... .	21·7	11·1	16·3	17·8	......
15·3	18·2	13·0	13·8	− 0·3	21·7	12·1	19·0	17·6	−0·2
10·2†	9·6†	10·5	10·1	−4·0	20·0	11·5	17·0	16·1	−1·7
14·8	12·5	16·5	14·6	+0·5	18·8	10·7	16·5	15·3	−2·5
16·3	13·5	17·2	14·1	......	18·5	13·7	16·8	17·8	.. ...
17·5	12·6	15·5	15·2	+1·1	20·0	11·8	16·7	16·1	−1·7
17·1	13·0	16·5	15·5	+1·4	21·0	14·8	20·2	18·6	+0·8
19·5	14·1	14·8	16·1	+2·0	21·0	15·0	22·1	19·3	+1·5
17·5	13·3	15·2	15·3	+1·2	19·3	14·7	21·2	18·4	+0·6
17·5	11·5	18·	14·1	......	22·5	18·5	21·8	17·8	......
16·3	12·7	14·4	.. ...	......	20·4	13·3	18·7	......	... ..

† Very weedy.

TABLE IV.—Showing variations due to planting at different times.

Period of Planting.	Federation. Yield per acre.			F (R1). Yield per acre.			John Brown. Yield per acre.		
	Thin seeding.	Medium seeding.	Thick seeding.	Thin seeding.	Medium seeding.	Thick seeding.	Thin seeding.	Medium seeding.	Thick seeding.
	bush.	bush.	bush.	bush.	bush.	bush.	bush.	bush.	bush.
Early planting	26·9	22·3	22 8	20·7	16·4	20·1	....	16·0	17·0
Mid-season planting ..	30·3	32·9	39 0	17·1	19·2	22·8	26·1	31·3	31·7
Late planting	14·6	16 3	20·4	13·6	12·7	13·3	14·4	14·4	18 7

TABLE V.—Showing variations due to the quantity of seed used.

Quantity of Seed used per acre	Early Planting. Yield per acre.			Mid-season Planting. Yield per acre.			Late Planting. Yield per acre.		
	Federation.	F (R1).	John Brown.	Federation.	F (R1).	John Brown.	Federation.	F (R1).	John Brown
	bush.	bush	bush.	bush.	bush.	bush.	bush.	bush	bush.
20 pounds	26·9	20·7	...	30 3	17·1	26·1	14·6	13·6	14·4
40 "	22·3	16·4	16·0	32·9	19·2	31·3	16·3	12·7	14·4
60 "	22·8	20·1	17·0	39·0	22·8	31·7	20·4	13·3	18·7

During the progress of these experiments, variations in the appearance of the plots were noticeable, but on no section could any conclusion be drawn as to the effect of the fertilisers. It was apparent that the heavier seedings kept the growth of weeds in check much better than did the lighter ones. Owing to the very favourable character of the season, the first or early planted section had made such rank growth by July that parts of it became laid, and it was necessary to either cut it or eat it off. As stock for eating off were not available, the crop was cut with the scythe, removed, and made into ensilage during the third week in July.

When the planting was late, the results, as might be expected, are in favour of heavy seeding. With two varieties, the best results were obtained when 60 lb. of seed per acre was used. With the macaroni wheat the amount of seed had apparently little effect upon the yield. This is the more remarkable as this wheat stooled less freely than either of the other two, which are bread wheats.

The results from the use of fertilisers are so different and fail so utterly to confirm one another that it is impossible to draw any conclusion from them. No doubt much of the variation was due to lack of thorough cultivation, and to our inability in so short a time (for the land had been under timber less than twelve months prior to planting) to render the physical condition of the soil at all even or regular.

Taking the results as a whole, it looks as if the direct application of fertilisers on new land is not advisable, but in view of the cases of increased yield on several of the fertilised plots, and the general increase in the heavily-seeded portion of the mid-season section, where the heaviest yields were obtained, it is apparently a good business policy to use fertilisers; and the practice should be continued until (if ever) it has been shown to be unsound or undesirable.

Discussion of Results.

It is to be understood that any remarks which may be made with regard to these results only apply to this season's experiments, and will probably have to be modified in the future.

From the varied character of the results which have been obtained, it is evident that other factors besides rainfall exercise a most important influence upon the production of wheat. This conclusion is confirmed by the whole of the work conducted this year. To some, such a conclusion may appear unnecessary; but there are large numbers of our farmers who believe that practically the yield of the wheat crop is entirely a question of rainfall.

The results obtained in the case of each of the three varieties under trial indicate that, *in a season like the last*, mid-season sowing is preferable to very early or very late. From the results which were obtained after cutting the early forward crop—similar to feeding-off, except that the crop received no manure from the eating off stock—it seems doubtful if feeding-off young crops, unless it be necessary to do so on account of the excessively rank growth, increases the yield of grain. This is a matter which will be determined by future trials.

With mid-season planting the results indicate that it is advisable to use a liberal amount of seed, and the same, as might be expected, is the case with late seeding.

Experiment II.

Ploughing Experiments.

The object of the following experiments is to determine—

(*a*) The comparative effects of ploughing with the disc and mould-board types of plough—
 (1) On the resulting crop.
 (2) On the texture and fertility of the soil, and especially on the maintenance of its fertility.

(*b*) The comparative effects on the resulting crop of deep and shallow ploughing with each of these ploughs—
 (1) When a fertiliser is used.
 (2) Without a fertiliser.

It is proposed to increase the scope of these experiments so as to include some in which the soil is prepared for the crop by the use of the disc and mould-board ploughs in conjunction. It is also proposed to study the effects

of subsoiling carried out systematically and in different manners. The ploughs which were made use of in these experiments, as representative of their respective types, were the "Secretary" double-furrow disc plough and the "Hornsby" double-furrow DD3 mould-board plough. In order that the work done by the mould-board plough might present a fair contrast to that of the disc, a plough with a fairly long mould-board was selected. The accompanying plans will show the arrangement of the plots for this experiment.

Preparation of the Soil.

Early in the year (1905) each of the plots was ploughed shallow with the disc or mould-board plough, as the requirements of the experiment demanded. This was done for the purpose of encouraging the seeds of weeds to germinate and grow, with the ultimate object of destroying them by means of the subsequent ploughings, and also of forming a soil-mulch for the purpose of conserving any moisture which might be supplied by summer rains. Unfortunately, dry weather set in immediately afterwards and continued, and the conditions which were provided for were not present.

It is worthy of notice that, in consequence of the dryness of the weather, the new ground was too hard for really good work to be done by either plough, and that it was found that, under the conditions which prevailed, the mould-board plough was able to plough harder ground and to do better work than could the disc plough. Despite all our efforts, the disc plough refused to remain in the ground when very hard patches were encountered. It is only right to say, however, that whilst ploughing other plots during the spring, when the conditions were different—that is to say, when the ground was moist and covered with a rank growth of grass and weeds—we had to discontinue using the mould-board plough and had to use the disc alone, on account of the former becoming so frequently choked. When this was the case, the disc plough did very satisfactory work. In connection with this subject, an interesting point was made manifest when this land was being harrowed after remaining until after harvest in the condition it had been left in by the plough. When it was being harrowed, it was found that the portion which had been broken up with the disc plough broke down with ease into an excellent tilth, while the harrow could hardly make any impression on the portion which the mould-board had ploughed. The harrowing of both portions was done at the same time and across the furrows. The depth of the ploughing was about 5 inches with both ploughs.

A second ploughing was given to each section during the last week of May and the first week of June. Owing to the rains which had recently fallen, excellent work was done with both ploughs, and at the requisite depths. During this second ploughing it was noticed that from 15 to 20 per cent. more ground could be ploughed daily with the disc than with the mould-board plough, the same team being used in both cases. Immediately after ploughing the ground was brought to a fine tilth by harrowing.

Planting the Seed.

The variety of wheat which was used for these experiments was "Bobs." The seed was sown on 21st and 22nd June, with a disc drill, at the rate of 42 lb. per acre. On the plots, which were to receive it, 44 lb. of 17 per cent. superphosphate per acre was applied at the same time as the seed. Rain fell almost immediately after the seed was sown, and on this account we were unable to harrow the ground at once. As the weather continued to be showery, it was six weeks before the ground had become dry enough to harrow. This moist weather, as may readily be imagined, afforded splendid opportunity for weed seeds to germinate and make good growth. It was noticed that the growth of weeds was very much greater in the land which had been ploughed with the disc plough than where the mould-board had been used. From the experience of this season, which has been an exceedingly favourable one for obtaining information on the subject, it has been made evident that ploughing with the mould-board plough, by burying the seeds, discourages the growth of weeds to a very much greater extent than does the work of the disc plough. This, of course, is a great gain with all weeds except those the seeds of which are able to retain their vitality for a long time in the ground when they are buried too deep to germinate; with them the advantage is much less certain.

It ought to be stated here that the main or even a primary object of these comparative experiments with the disc and mould-board ploughs is not to determine the cost at which they respectively do their work, or the thoroughness with which they break up the soil. The main object we have had before us in designing them is to see whether the leaving of the decayed surface vegetable matter on the surface, or in the position in which it is found in the greatest proportion in nature, instead of turning it under and mixing it with the upper 6 inches or so of soil, as is usually done when the mould-board plough is used, will have the effect of enabling rain-water to soak more easily into the soil, and will prevent the surface from becoming caked after rains. A difference in this respect apparently showed itself in the circumstance mentioned above, but the land which had been ploughed with the turnover plough, and had been left unharrowed for some time, was found to be very much harder and more difficult to harrow than was the case with that which had been ploughed with the disc plough. In the new experiments which have been alluded to, in which it is proposed to use both the disc and mould-board ploughs in conjunction, all the deep ploughing will be done with the disc plough, and the mould-board will only be used to turn a furrow of no greater depth than is necessary for covering the surface-vegetation and securing its humification, as well as for causing the seeds of weeds to germinate. It is desired to cover the surface with a thin layer or blanket of soil which is as rich in vegetable matter as we can manage to make it. Such a blanket will allow rains to soak in better, will prevent the surface from caking, and will diminish the loss of moisture from evaporation. It is hoped that the decayed roots which are left by crops will provide enough vegetable matter for the requirements of the soil which lies immediately below this blanket.

Harvesting.

The ripening of the crop occurred about 20th December. Before harvesting the area of each plot was reduced to one-third (⅓) of an acre by cutting as much as was necessary from the ends of each plot. By doing this, the variations due to outside influences were got rid of. The plots were harvested with the stripper on 26th, 27th, and 28th December. The grain was taken direct from the stripper and weighed as it left the winnower. The yields per acre have been computed from the actual weights of grain which were obtained in this manner, and will be found in the tables which follow:—

TABLE I.—Results from using the Disc Plough.

4 inches deep.			6 inches deep.			8 inches deep.		
Plot No.	Yield per acre.		Plot No.	Yield per acre.		Plot No.	Yield per acre.	
	With Fertiliser.	Without Fertiliser.		With Fertiliser.	Without Fertiliser.		With Fertiliser.	Without Fertiliser.
	bush.	bush.		bush.	bush.		bush.	bush.
C IV 1 ..	9·50	....	C V 1 ..	8·85	......	C VI 1	10·30	.
2 .	.....	10·00	2 ..	.....	8·75	2.	....	11·90
3 .	10·00	.....	3 ..	8·45	.....	3.	10·25	..
4 ..	.....	9·55	4 ..	......	8·35	4	...	9·55
Average yield of manured and unmanured plots	9·75	9·77		8·65	8·55		10·27	10·72
Average yield of each four plots ploughed the same depth.	9·76			8·60			10·50	

TABLE II.—Results from using the Mould-board Plough.

4 inches deep.			6 inches deep.			8 inches deep.		
Plot No.	Yield per acre.		Plot No.	Yield per acre.		Plot No.	Yield per acre.	
	With Fertiliser.	Without Fertiliser		With Fertiliser.	Without Fertiliser.		With Fertiliser.	Without Fertiliser.
	bush.	bush.		bush.	bush.		bush.	bush.
D IV 1	14·00	.....	D V 1 ..	17·20	......	D VI 1 ..	17·55	......
2	......	13·20	2 ..	......	15·20	2 ..	......	15·00
3 . ..	15·00	......	3 ..	15·40	.....	3 ..	15·55	......
4	......	13·45	4 ..	......	15·60	4 ..	......	14·65
Average of two plots.	14·50	13·32		16·30	15·40		16·52	14·82
Average of four plots.	13·91			15·88			15·67	

TABLE III.—Variations due to Depth of Ploughing.

Disc Plough.				Mould-board Plough.			
Plot.	Depth Ploughed.	Yield per acre.	Difference in favour of Depth Ploughed.	Plot.	Depth Ploughed.	Yield per acre.	Difference in favour of Depth Ploughed.
		bush.	bush.			bush.	bush.
C IV .	4 inches ..	9·76	1·16	D IV ..	4 inches .	13·91	. .
C V .	6 "	8·60	....	D V ..	6 " ..	15·88	1·97
C VI ..	8 " .	10·50	1·90	D VI ..	8 " ..	15·67	1·76

TABLE IV.—Variations due to character of Plough used.

Depth Ploughed.	Disc Plough.		Mould-board Plough.		Increase due to use of Mould-board Plough.
	Plot No.	Yield per acre.	Plot No.	Yield per acre.	
		bush.		bush.	bush.
Four inches	C IV ..	9·76	D IV .	13·91	4·15
Six "	C V ..	8 60	D V .	15·88	7·28
Eight "	C VI ..	10·50	D VI .	15·67	5·17

TABLE V.—The effect of a Fertiliser.

Depth Ploughed.	Disc Plough.				Mould-board Plough.			
	Yield per acre.		Increase due to Fertiliser	Decrease due to Fertiliser.	Yield per acre.		Increase due to Fertiliser.	Decrease due to Fertiliser.
	With Fertiliser.	Without Fertiliser.			With Fertiliser.	Without Fertiliser.		
	bush.	bush.	bush.	bush.	bush.	bush.	bush.	bush.
Four inches . .	9·75	9·77	......	02	14 50	13·32	1·18	....
Six "	8·65	8·55	10	......	16·30	15·40	·90	....
Eight " . .	10·27	10·72	. ....	·45	16·52	14·82	1·70	.. .

Discussion of Results.

It is evident from these results that under similar conditions to those which prevailed last season, *i.e.*, in new ground of a loamy character and during a wet autumn and winter, the use of the mould-board plough is preferable to the disc. It may be (but this is only put forward as an opinion), that the greater yield which followed the use of the mould-board plough was mainly due to the manner in which it hinders the germination of weed-seeds. This is supported to some extent * by the magnificent crops which were obtained on other portions of the farm which had been ploughed with the disc plough exclusively, but under circumstances which allowed the weeds to be destroyed after they had begun to grow. It seems

* The observations, which were made during the past season, leave no room for doubting that the presence of weeds in a wheat crop has a very great effect on the yield of grain.

that the character of the plough will determine, to some extent, the depth to be ploughed, and it may also affect the results which follow the direct application of a fertiliser. The results which were obtained in this, the first year, indicate that, if the mould-board plough be used, 6 inches is a much better depth to plough than 4 inches, and that it is doubtful if anything is gained by going deeper. The use of superphosphates appears to be beneficial at all the depths of ploughing which were tried, but most beneficial when the ploughing is deepest. In the work which was done with the disc plough, a depth of 8 inches seems to be preferable to shallower ploughing, but a result which is not altogether confirmatory of the benefits of ploughing deep with this plough

A good result from the use of the Disc Plough.

is that which is furnished in the case in which the shallow (4-inch) gave better results than the deeper (6-inch) ploughing. In this section, the effect of fertilisers has apparently been to decrease the yield. This decrease is so regular and general that one is led to suspect that an effect of the application of them has been to stimulate the growth of weeds, and strengthen them, and in this way to lessen the supply of plant-food for the wheat crop, and so to reduce the yield of grain. If this be the case, it may afford an explanation of the apparently contradictory result which is shown in the decreased yield which followed ploughing 6 inches deep. This smaller yield is apparently due to the treatment the soil had received; for the yields in that group of plots are so even and regular, and the differences between the yields of them and of the adjacent plots on either side so marked, that it is hardly reasonable to assume that these smaller yields are due to unit inequality of the conditions or unevenness in the original state of the plots.

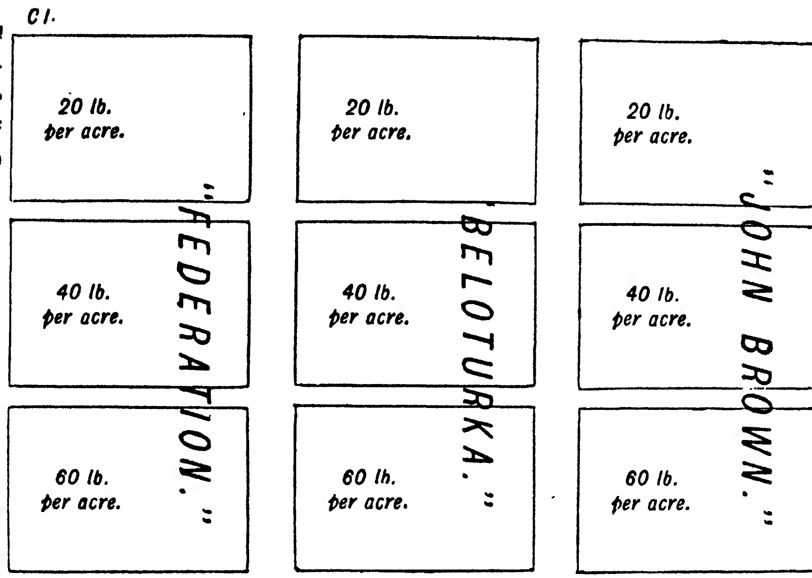


Fig. 1.—Seeding Experiments, Cowra Experimental Farm.—Plan of the Early Planting Section.

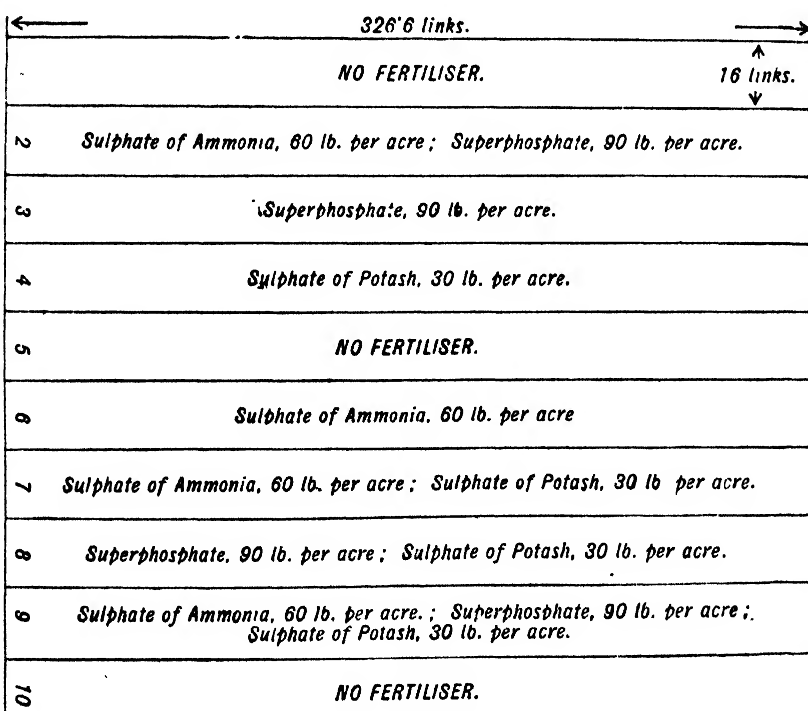
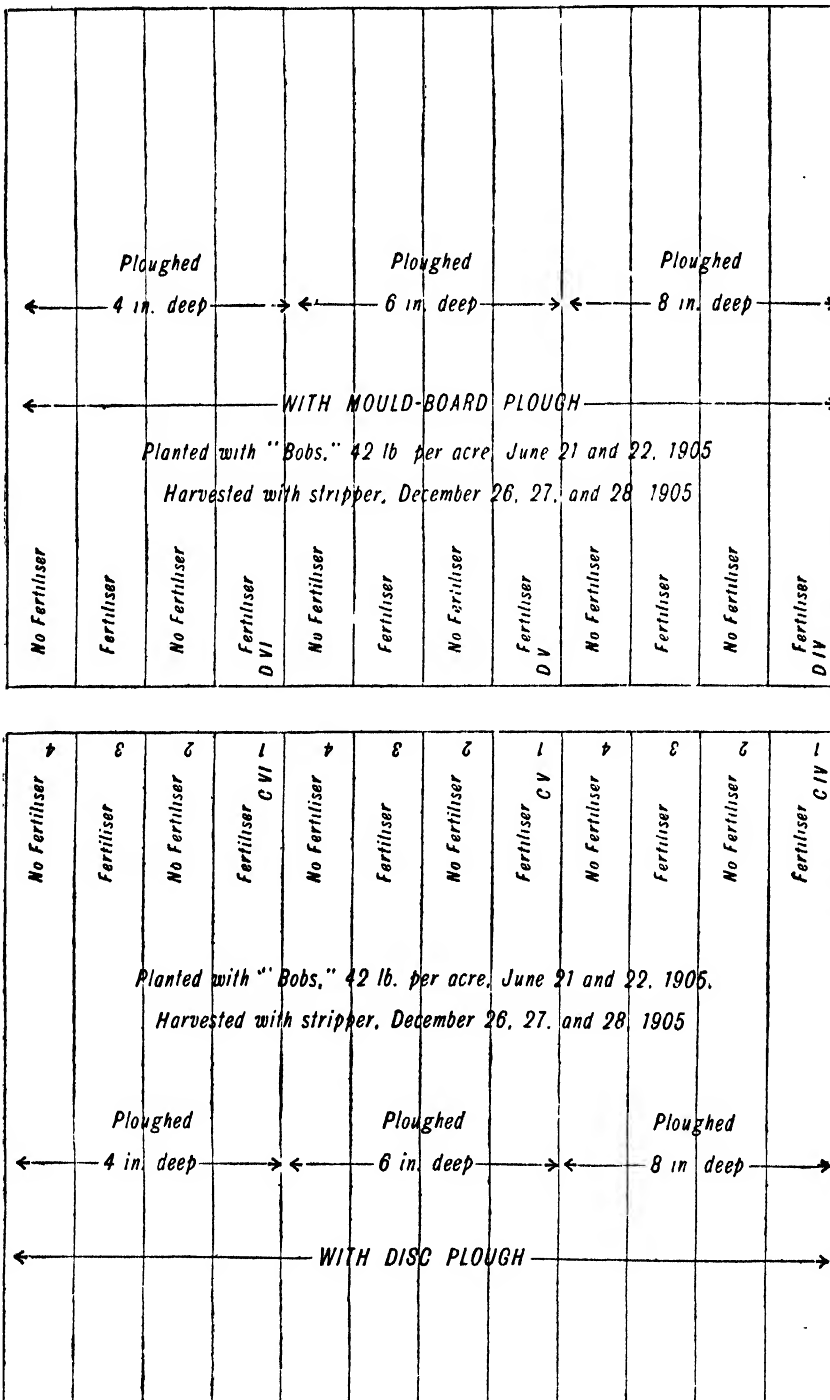


Fig. 2.—Seeding Experiments, Cowra Experiment Farm.—Plan showing arrangement of the fertiliser and fertilised plot in each section, containing one of the specified amounts of seed.



Experiment II, 1905.—Sketch showing arrangement of Plots in Ploughing Experiment, Cowra Experimental Farm.

Grain Elevators.

N. A. COBB.

[Continued from page 235.]

II.

European Elevators.

The elevator system has spread to Europe, and continues to find favour there, though the type of structure in use at many of the European ports

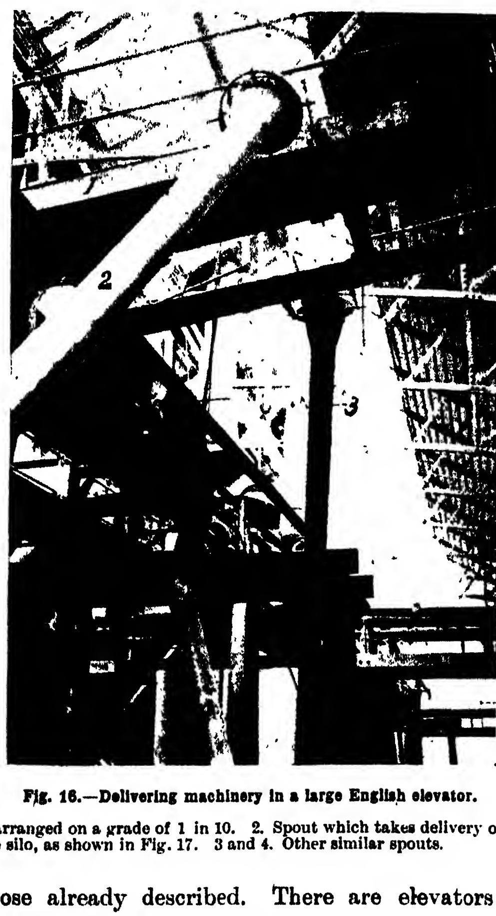


Fig. 16.—Delivering machinery in a large English elevator.

1. Main grain belt arranged on a grade of 1 in 10. 2. Spout which takes delivery of grain from the belt, 1, and guides it to the silo, as shown in Fig. 17. 3 and 4. Other similar spouts.

differs from those already described. There are elevators of the purely American type, made of wood and put up by American contractors; of these

an example may be seen at Manchester, England. At Liverpool, Antwerp, and other ports, however, an entirely different class of structure prevails. While the machinery is practically the same as that already described, the building in which it is housed is quite different, being of brick and nearly fireproof. The insurance on brick elevators is 3s. per £100, while that on wooden elevators is 25s. per £100 ; this great difference is considered by many European companies to more than justify the additional expense involved in a brick structure.

The brick elevator of The Grain Storage and Transportation Co., of Liverpool, contains some 200 hexagonal bins, or "silos," each holding about 200 tons of grain. The silos are about 15 feet in diameter, and 70 feet deep, and rest on arched brick tunnels. These tunnels are tapped on the sides and top, the openings thus made forming outlets for the different silos. The grain belts run along these tunnels, one to each tunnel. The spouts are of English make, and are the same as shown in Fig. 18. These spouts are kept locked, and the keys remain at the head office, being given out to assistants only when grain is to be delivered. The assistant receives his directions in the brief form, "Deliver 100 tons from No. 67." (See Figs. 16, 17, and 18).

Brick elevators, put up by incompetent engineers, have sometimes collapsed ; no one but the thoroughly competent and experienced engineer should be allowed to plan or erect elevators of this kind.

The Société Anonyme des Magazins d'Anvers owns a large brick elevator at Antwerp, of an estimated capacity of 1,000,000 bushels. This elevator delivers bagged wheat for the most part, but is prepared to deliver in bulk. Grain cars of the American pattern stand ready to carry this latter.

Pneumatic Elevators.

Grain can be elevated by suction. If a tube through which air is being pumped is lowered over grain, so that the mouth of the tube, at which the air is entering, comes near the surface of the grain, this latter will be drawn up into the tube and carried along with the air ; or, to state the same thing in a different way, if grain or similar material be forced into a tube along with air, by means of a fan, it will pass along the tube with the air, so long as the velocity of the air is maintained at a certain rate which is within the reach of ordinary machinery.

This fact has been utilised in a number of ways. Elevators have been constructed on this principle, as have also ensilage carriers. The system possesses many advantages, in fact all the advantages of other pneumatic carriers, such as speed, and a high degree of adaptability to crooked routes. Unfortunately, however, this pneumatic system is so expensive as to preclude its adoption in commercial elevators. I saw no evidence, in either Europe or America, that elevators of this class were gaining ground, and until invention finds a way of lessening the cost of this attractive system of transportation, we may leave it entirely out of consideration so far as elevators are concerned.

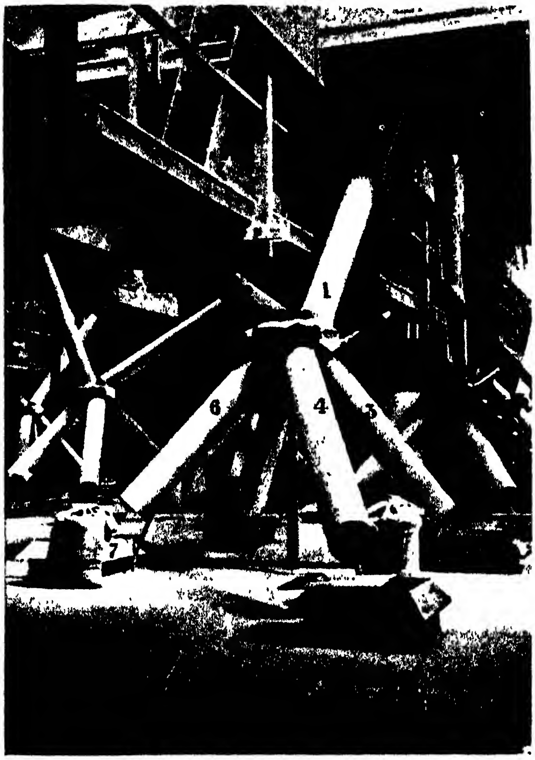


Fig. 17.—Delivery Spouts at the top of silos in a large English elevator.

1, is the lower part of the spout 2, shown in Fig 16. Fig. 2 of the present illustration is another similar spout. By pulling one of four slides, as 11, the grain from 1 or 2 may be delivered to any of the silos 7, 8, 9, 10, by aid of one of the spouts 3, 4, 5, 6. Of course only the mouths of the silos are shown (7, 8, 9, 10, &c.), this floor being over the silos and some 80 feet above the ground.

Fig. 18.—Bagging arrangements on the second floor of an English elevator. Shoots from this floor guide the bags of grain to the railway trucks.

1, weighing hopper hung on a steelyard; 2, mouth of a silo; 3, lever for opening and closing the mouth of the silo; 4, steelyard; 5, weights.

Elevators in this State.

While elevators and storage in bulk have not been extensively tried in New South Wales, there are some elevator plants the history of which should be mentioned. Over ten years ago Mr. J. Crago, of Bathurst, built a wooden silo, or bin, of a cubical shape, 30 feet deep, holding, therefore, some 20,000 bushels. (Fig. 19.)

Some three years ago Mr. Crago put up a flour-mill in Sydney, and, in connection therewith, he constructed, about a year ago, an elevator of about 70,000 bushels capacity, consisting of wooden silos or bins 8 feet across, and 47 feet deep.

Both these ventures have proved successful, and Mr. Crago informed me that, in the latter case, he is sorry he did not make his elevator twice as large. No special difficulties due to climate have been encountered. The

Fig. 19.—Elevator erected by Mr. F. Crago at Sydney (Newtown) in connection with his Flour-mills; capacity, 75,000 bushels.

timber used in these two cases was ironbark and Oregon pine, and they have answered well.

About a year ago Messrs. Gillespie Brothers & Co. began the construction of a wooden elevator at the Anchor Roller Flour-mills in Sydney. This elevator has now been in operation for over six months, and is, in the words of the proprietor, "a great success." It consists of thirty-five bins or silos, 8 feet across and 40 feet deep, the full capacity being about 70,000 bushels. The framework is of ironbark, and the silos of Oregon pine. The machinery requires 20-horse power, and handles 35 tons per hour. (Fig. 20.)

All the above elevators are used in connection with flour-mills, and are, therefore, not of the strictly commercial type, having, as they do, special apparatus for mixing grain, and lacking for the most part the special weighing machinery so necessary in the commercial handling of grain. They nevertheless

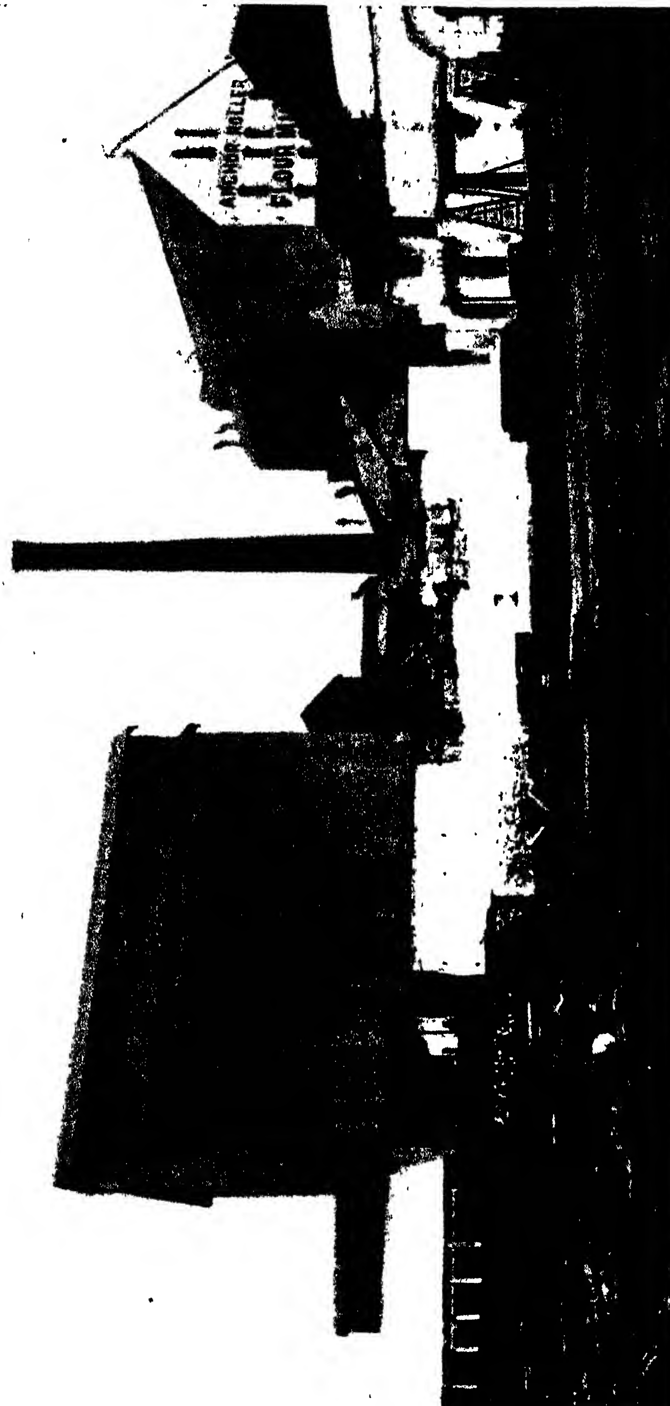


Fig. 20.—Elevator erected by Gillespie Brothers & Co. in connection with their Anchor Flour-mills at Sydney; capacity, 75,000 bushels.

show, on a small scale, all the essential features of the grain-elevator as used elsewhere, and, from an examination of them, we may conclude,—

1. That the climate and wheat of Australia do not place any marked difficulties in the way of handling wheat in bulk.
2. That, in connection with flour-mills, the elevator is, in Australia, as everywhere else, a marked success.
3. That the insurance charged here on wooden elevators is not exorbitant.
4. That colonial timber is, to a certain extent, suitable for the construction of elevators.
5. That the cost of constructing elevators in New South Wales is not prohibitive.

To those conclusions I venture to add my own opinion, based on wide observation, that—

1. Experiment will prove that colonial timber is entirely suitable to the construction of wooden elevators.
2. That elevators will prove of benefit in handling grain that has been injured by mould, &c.

A careful consideration of these conclusions, based on elevators already constructed in New South Wales by the above progressive millers, will show to what an extent the supposed difficulties in connection with elevators in Australia have vanished. A little enterprise has caused them to disappear "like mist before the rising sun." What reason is there to suppose that the further spread of this system of handling grain will not prove equally successful?

Local Objections to the Elevator System.

The following objections to the elevator system have been raised :—

1. That we shall have to alter our methods of harvesting and our harvesting machinery.
2. That we have not sufficient grain.
3. That our distance from market is too great.
4. That we have no suitable ships.
5. That company monopolies in grain freight would be encouraged.
6. That the grain would heat, rot, mould, shrink, and get weevilly, and be attacked by rats, mice, and moths.
7. That no restrictions have been placed in the way of the large buyer putting up elevators, and yet he has not put them up ; hence they cannot be a good thing.
8. Elevators encourage wheat corners.

All objections that are raised to the expenditure of a large sum of money in the construction of elevators in Australia should be carefully considered. The subject is too important to be treated in a hasty manner. Let us, therefore, discuss each of the above, and determine what weight should be attached to it :—

1. *Alterations in our methods of harvesting.*—Much of our grain is harvested with the reaper and binder, and is afterwards thrashed and bagged. No difficulty should be experienced by farmers who work in this manner.

Unless they choose, they need make no material change. They may reap, thrash, and bag as usual, and deliver to the elevator, where they can unbag as easily as they could unload in any other manner, and *receive back their bags.*

If they wish, however, they may allow the thrashing machine to deliver into a grain-box on a dray or waggon, instead of into bags as at present. This is an alteration in method only so far as cartage is concerned. It is an alteration calling for no great outlay. Indeed, the cost of bags for two or three seasons under the present system would more than pay for the boxes which would have to be substituted. Should the farmer prefer to buy a special waggon for his grain, such as is described elsewhere, it is necessary to remember that these waggons are general-purpose waggons, and the expense need not be all charged up against the carriage of grain in bulk.

It is interesting, and sometimes laughable, to consider our readiness to raise objections to proposed changes. The man who would draw a load of sand to the station without ever thinking of bagging it, immediately raises objections to doing the same thing with grain—largely, it may be suspected, because neither he nor his forefathers ever handled grain in this manner. Handling in bulk, or in boxes, as we may say, is really a simpler matter than handling in bags. There are no bags to buy, and there is no bagging to do. There is, however, a box to provide, and the thrashing machine or cleaning machine to so set as to deliver into the box placed on the waggon or dray. If we set these two things, the one over against the other, it seems to me that the balance is in favour of the box, both as to expense and convenience. In any case, no farmer is obliged to make the change against his will simply because elevators are adopted ; he can still go on in the old way and simply unbag at the elevator, get his bags back, and be so much in. And this is not unfrequently done by small farmers in the north-western part of the United States, as I have repeatedly observed.

Much the same may be said of the large number of farmers who use the stripper. They need make no change unless they prefer. If they do make a change, it is a minor change in the cleaner.

Where headers are used the changes required are the same as where reapers and binders are used.

The few combined harvesters in use would naturally go on as usual, and the wheat would have to be unbagged, unless the owner could contrive a bulking arrangement as an attachment to his harvesting machine.

In any of these cases no farmer could avoid the benefit that would come to the wheat industry, because of the accuracy and speed that would be introduced into the wheat trade.

2. *Insufficiency of our Grain Crop.*—It must be borne in mind that elevators handle all kinds of grain, and that we must not consider wheat alone.

Elevators have been introduced into the State of Texas, and have been successful there. I know of no nearer parallel to the case of New South Wales. The climates, populations, and social conditions of the two States are in many ways similar. The Texas wheat crop, in 1899, was 9,000,000

bushels. To this must be added several million bushels which would come in from Oklahama. Texas, and that part of Oklahama served by the Texan country elevators and the Galveston terminal elevators make up an area about equal to that of New South Wales, as will be seen by the following table:—

	Area in Square Miles.	Population.	Wheat Crop.	
		1890.	1892.	1905.
New South Wales ...	310,000	1,330,009	13,500,000	20,000,000
Texas	265,000	2,235,523	9,000,500	....

From the above table it will be seen that the areas, population, and wheat crops in the two States furnish a fair basis of comparison. Unfortunately, however, the Texas railways cannot fairly be compared with those in Australia in considering the elevator question, because the railways of Texas are now, and were at the time of the introduction there of the elevator system, connected with the other railways of the United States, and, in consequence, cars from other parts of the country could be run into Texas to meet the growth and emergencies of the elevators. When we consider the fact that much of the expense of inaugurating the elevator system in New South Wales must go toward paying for suitable rolling-stock, we see how careful we must be in drawing conclusions from the above comparison.

Notwithstanding this drawback, the comparison is worth making, and teaches that if the necessary rolling-stock is provided, the elevator system can be profitably applied to an annual product of 9,000,000 to 15,000,000 bushels on an area equal to, and populated like, that of New South Wales.

What is the minimum quantity of wheat that can be profitably handled by an elevator? The question is one that must be answered according to surrounding circumstances. The manager of a large Liverpool storage and elevator company told me that, no matter what was ultimately to be done with even so small a quantity as a single cargo of bagged wheat received at Liverpool, the best thing to do first is to bulk it. Wheat from Australia, for instance, is unbagged at the ship's rail and shot into punts, and elevated weighed, examined, and graded, no matter if it is to be sold again in bags the next day, as sometimes occurs.

A flood of light is thrown on this subject by the results of private enterprise in New South Wales. As pointed out in another part of this article, several small elevators have already been constructed in this State by enterprising millers, and in each case the owner pronounces his elevator a marked success. If these elevators of some 75,000 bushels capacity are a success in connection with flour-mills, what stands in the way of their successful introduction to a larger sphere? If it is economical to handle the grain in bulk in the comparatively small quantity used by a single flour-mill, how much more should it be to handle in the same manner all the grain produced in the State?

I do not forget that the handling of wheat in a flour-mill differs from that for purely commercial purposes. Making full allowance for this fact, there

is such a close resemblance as, in view of the success of these small Sydney elevators, to nullify the objection so frequently raised by those who consider that our wheat crop, or wheat export, is too small to justify the use of elevators.

3. *Our distance from the Market is too great.*—That depends upon what market is meant. If England alone is referred to, this objection certainly may have force, for it cannot be denied that the carriage of grain in bulk across the equator, and on voyages of forty days or more, is a matter in which we have too little experience to enable us to assume that it can be successfully done without any extra precautions. This is a question that a few trial shipments would settle at once and for ever, at a comparatively small cost.

[In the trial shipment made in 1901 by the s.s. "Persic," wheat carried in good condition, and was most favourably reported on from England.—Ed. *A.G.*]

England, however, is not the only market. The requirement of the colonial market is at present larger than the exportable surplus, and elevators are just as useful in handling the locally-consumed grain as in dealing with the export surplus. There is a widespread notion that the elevator is a machine for exporting grain, and is practically useful for no other purpose. This is far from being the case. In the United States, for instance, the country elevators would continue to exist and thrive if that country did not export a single bushel of grain, and, as has been said, the country elevators are the main feature of its elevator system.

It does not do to forget that China and Japan are importers of wheat. To meet the demands of these markets elevators have been erected on the Pacific coast of the United States, and grain is already being shipped from there to Asia in considerable quantities. Preparations are being made to carry this wheat in bulk,—if, indeed, this is not already accomplished. We are nearer the Asiatic market than the United States, and should be able to compete with them for this trade. This wheat export trade to Asia is certainly one in which the distance objection would not hold.

4. *That we have no ships suitable for carrying in bulk.*—This objection rests on misinformation. Suitable ships are available. They may not be in port at the present moment in sufficient numbers, but with moderate notice they could easily be mustered. There are companies trading regularly to Australia which carry grain in bulk on the Atlantic, and in their case it would only be necessary to divert suitable vessels to Australia. There are many "tramp" steamers engaged in carrying grain on the Atlantic with no binding contract as to a particular route or trade. These would certainly put in an appearance as soon as it became known that we have a grain trade belonging to their class.

5. *Company monopolies in freight will be encouraged.*—If the foregoing objection with regard to ships does not hold good, this present objection falls to the ground. Moreover, supposing there was but one company that carried in bulk from a given port, the producers would not be wholly at the mercy of that company, because the present carrying vessels constitute a competing

factor. The elevators can deliver in bags as well as in bulk, and can bag more cheaply than can the producer. Hence the company carrying in bulk would be compelled to carry at a rate competing with present charges.

Even if bulk-carrying vessels were not at hand at the required moment, any other available craft could therefore be utilised at the expense of bagging.

6. *That the grain would heat, rot, mould, shrink, and get weevilly, and be attacked by rats, mice, and moths.*—Grain in bags is equally subject to these evils. Grain in bulk is less liable to attacks of weevils, moths, rats, and mice than grain in bags, and accordingly suffers less. The ventilation furnished in stacks of bagged wheat may in some cases be beneficial as regards heating, moulding, and so on, but in other cases it is harmful. It is certainly easier to check these diseases in bulked wheat than in bagged wheat. In an elevator the bins can be emptied and the grain dried at a minimum of cost. Mr. Crago, of Bathurst, has used wooden silos for storage of grain for upwards of ten years, and has had no special difficulty from any of these sources.

The fact that our grain is usually harvested in a drier state than in most other countries, is in favour of its freedom from mouldiness when stored in elevators.

7. *No restrictions have been placed in the way of large buyers fitting up elevators, and yet they have not done so; hence elevators cannot be a good thing.*—Another misconception. There have been no suitable railway facilities for the interior transportation of grain in bulk, and this is an almost fatal restriction. Elevators in the grain districts are white elephants unless supplemented by the proper railway trucks. These two things must go hand-in-hand, and private enterprise cannot be expected to embark in the elevator business so long as our railways lack the particular kind of trucks necessary to serve the elevators.

8. *Wheat corners.*—It has been said that elevators encourage the cornering of wheat—*i.e.*, the buying up by speculators of large quantities of wheat when prices are low with a view to forcing up the price by creating a shortage in the amount of wheat available in the market. This has often been done in the United States, and it is certain that the American elevators facilitate such operations. As soon as the new crop comes into the elevators, its quantity becomes known and more or less subject to manipulation by speculators. The "buying-up" of grain is much facilitated by its accumulation in large quantities in elevators.

Thus far it seems as if this objection is a valid one; nevertheless, a little further consideration shows that State ownership introduces a factor that may completely alter the case. For, if the State owns and controls the elevators, it is in a position to enforce wholesome regulations against the improper manipulation of the wheat market. Granting that "cornering" is an evil, it would be hard to devise a better way to remedy that evil than to place the grain in charge of the State in a free country like Australia. Under proper regulations, no one could corner the market without the knowledge of the State, which would have power to interfere if the people chose to give it that power.

I am informed that the elevators erected some years ago in the Argentine are only now coming to be appreciated. The reason for this is two-fold. Firstly, labour is very cheap in that country, and wherever labour is very low-priced, the introduction of any kind of labour-saving machinery is more difficult than in a country like Australia, where labour is high-priced. Secondly, the necessary railway facilities for carriage in bulk were not provided.

Introduction of Elevators into Australia.

Listening to a conversation recently I heard a shrewd observer hold forth somewhat as follows :—" You may rely upon it the millers and merchants of Australia will oppose the introduction of elevators by the Government. Why? Well, I'll tell you. At present the millers and merchants know more about the grain than anybody else, and they benefit by it. In any deal the man who knows the most can get the benefit of any uncertainty, and, of course, in a grain deal the greatest element of uncertainty at present is the quality of the grain, and this uncertain element often yields the merchants and millers a nice profit because of their superior knowledge of the grain market. Now, this proposal to place practically all the grain in charge of the State with the power to grade it and treat buyer and seller alike will put the producers on a level with the buyers so far as a knowledge of the quality of the grain is concerned, and will to that extent benefit the producers at the expense of the present buyers. When the farmer can deliver to the State elevator and immediately receive an expert and impartial return as to the quantity and quality of his grain, he will be in a better position on the market than he is now, and, of course, those who now profit by his ignorance stand to lose just so much."

This opinion must stand for what it is worth. Personally, I think any opposition based on such grounds would soon collapse.

With regard to the introduction of elevators into Australia, there is hardly room for two opinions. My own opinion, expressed some years ago in the *Agricultural Gazette*, I find to be now stronger than ever. My observations during the last eighteen months show that the elevator system has gained greatly during the last ten years. Not only are wheat, corn, and all kinds of grain now almost universally handled by this method, but even such unpromising material as broken ore, coal, and road metal. All these are now elevated, graded, and delivered in a manner similar to grain. Coal is almost universally elevated, and stored at a height so as to be "on tap," so to speak, for railway engines, delivery teams, and ships. Coal is usually elevated by ordinary traction, in cars specially designed to unload instantaneously. I have seen hundreds of elevators in the various parts of the United States; in fact, they are now one of the commonplaces of the coal trade. I have collected material for a report on the superior mechanical methods used in constructing State roads in the United States. Among them is an elevator for mechanically producing, grading, and delivering road metal. Ore at mines

is also raised, stored, and delivered in a similar way. The coal elevators have set the grain men thinking, and now grain engineers are considering the feasibility of raising cars of grain to such an altitude as to unload by gravity at the top of the grain elevator.

Question of Ownership of the Elevators, State or Private.

The building of elevators by the Government is not the only possible way of introducing them into this country. It is of course certain that the box-cars must be provided by the Government as represented by the Railway Commissioners. But it would be possible to encourage private enterprise to put up elevators by placing a lower freight charge on grain in bulk.

We may suppose, for instance, the railways to offer to carry grain in bulk at a certain lower rate, provided it is delivered in certain quantity, and the cars loaded in a certain manner, and at a certain rate of speed, these provisos being such as to give the railways a reasonable chance to make a profit, and the rate such as to induce private enterprise to put up elevators.

State ownership of the elevators puts the State permanently in charge of the bulk of the grain food of the country. By certain persons, such a proposition may be regarded with fear.

Most of the proposals hitherto made concerning the erection of elevators in this country seem to assume that the proper place to make a beginning is at the point of export. To begin in New South Wales by putting up a single large elevator at Sydney would, in my opinion, be but a poor object-lesson. The benefit to be derived from the adoption of the system can only be secured by providing, simultaneously, elevators in the producing districts, and at the important points of consumption and export, and at the same time providing railway facilities for transportation in bulk. It we do not do all this, and content ourselves with building a single elevator in Sydney, we shall repeat the mistake made in the Argentine Republic. Would it not be better to wait a little than to make such a false start?

We shall not have long to wait. Australians educate themselves quickly, and they will not be long in seeing the advantages which the elevator system offers in a country where labour is as well paid as it is with us. The problem confronting the Government is one of economics, and not one of the superiority of the elevator over the present system, and the Government will not be long in finding a solution. Private enterprise has done much toward solving the question, and may be relied upon to continue to do so. If those who understand the benefits to be derived from the adoption of the elevator system do their duty, and keep the question agitated, the discussion can end in one way only, and that speedily.

Before many years we shall be wondering how we ever managed to get along without elevators.

The steps to be taken in introducing the grain elevator system into a country like New South Wales are, it seems to me, as follows, and in the following order:—

1. Introduction of railway facilities for the carriage of grain in bulk. This first step must be taken by those who own and control the railways.
2. Building of country elevators. Of these 100 to 200, of 20,000 to 40,000 bushels capacity, would be required to meet the present (1901) needs of New South Wales.
3. Building of large terminal elevators at the centres of consumption and export. Probably one or two of about 1,000,000 bushels capacity would meet present requirements in New South Wales.

Of these three steps the second is by far the most important. It is a lack of appreciation of the logical order of the above steps, and an ignorance of the importance of the country elevators, that has hampered the progress of the elevator system outside the United States, whence it is destined to spread to all grain-producing countries where labour is expensive.

It is not easy to recommend a trial of the elevator system on a small scale. A single elevator will not bring a decided gain, nor be an adequate object-lesson; but elevators might be introduced on one railway line, and the beginning thus made ought to furnish a basis for further action.

I have not given the matter that careful attention it will doubtless receive at the hands of railway and building experts; but, looking at it in my way, I should estimate the cost of inaugurating wheat elevators in New South Wales at no less than £400,000.

Finally, I will add that careful inquiry and reflection have convinced me that the introduction of grain elevators into Australia should be under some American auspices. No doubt American contractors would at first secure Australian contracts, as they have those of other countries; and such an arrangement would, in my opinion, be the best possible arrangement. By this I mean no disparagement to Australian engineers, who, on account of their better knowledge of local conditions, would, no doubt, soon, in the matter of constructing elevators, easily distance all competitors.

Forestry.

Some Practical Notes on Forestry suitable for New South Wales.

[Continued from page 56.]

J. H. MAIDEN,
Government Botanist and Director of the Botanic Gardens, Sydney.

XIII.

Uses of New South Wales Timbers.

In my "Notes on the Commercial Timbers of New South Wales," First Edition, 1895, Second Edition, 1904 (Government Printer, Sydney, price 1s.), will be found lists of our timbers adapted or recommended for special purposes. There can be no question that such a list, if properly compiled, will be most useful, if only because of its suggestive nature.

The following is an improved classification, but obviously it is grossly incomplete. When it is more complete, a better classification will be submitted. Additions will be made to it from two sources :—

1. Ascertainment of uses to which our timbers are put (with advantage) in various parts of the State at the present time.
2. Experiment as to new uses for our timbers.

Additions and suggestions will be gladly received, since manufactures are developing in New South Wales.

For the following statistical information (1904) in regard to timbers I am indebted to Mr. W. H. Hall, Acting Government Statistician :—

Imports.	Value.
	£
Timber—Architraves, mouldings, and skirtings of any material	4,188
Dressed, n.e.i.	82,057
Undressed Oregon, in sizes of 12 in. x 6 in. (or its equivalent) and over	74,109
Undressed, n.e.i., in sizes of 12 in. x 6 in. (or its equivalent) and over	11,846
Undressed, n.e.i., in sizes of less than 12 in. x 6 in. (or its equivalent)	214,306
Laths	8,791
Palings	116
Pickets, dressed	10
Pickets, undressed	12
Shingles	846
Doors of wood—	
1¾ in. and over	1,967
Over 1½ in. and under 1¾ in.	3,325
1½ in. and under ...	11,435
Hickory, undressed	644
Logs, not sawn, and spars in the rough .. .	7,163
Staves, undressed or roughly dressed, but not shaped...	4,530
New Zealand pine, undressed	128,495
Other (free)	11,775

Exports.	Value.
	£
Timber—Architraves, mouldings, and skirtings of any material	28
Dressed, n.e.i.	6,263
Undressed, n.e.i., in sizes of 12 in. x 6 in. (or its equivalent) and over	5,064
Undressed, n.e.i., in sizes of less than 12 in. x 6 in. (or its equivalent) .. .	161,643
Palings ...	5
Pickets, dressed	95
Shingles	90
Doors of wood—	
1¾ in. and over	328
Over 1½ in. and under 1¾ in.. ..	97
1½ in. and under ...	108
Logs, not sawn, and spars in the rough	12,043
Staves, undressed, or roughly dressed, but not shaped...	20
Other (free)	8,736

In addition, there is a heading called by the Customs "Manufactures of wicker wood, cane, &c.," which includes such articles made of wood, as casks, shooks, sashes, frames, bent timber, and wood cut into shape, and also walking sticks and canes, and articles manufactured from canes and rattans. I am, however, unable to separate the articles made of wood from the others, but should say that they comprise the greater part of the group. The total imports under this heading were £36,875, and the exports, £11.140.

CUSTOMS TARIFF.

Dutiable Goods.	Duties.	Special Exemptions.
110. Timber, viz. :—		
(A) Architraves, Mouldings, and Skirtings of any material, per 100 lineal feet.	5s.	(c) Hickory Spokes, dressed, 2 in. and under in diameter.
(B) Timber, dressed, n.e.i., per 100 superficial feet.	3s.	(d) Hickory, undressed.
(C) Timber, undressed, n.e.i., in sizes of 12 in. x 6 in. (or its equivalent) and over, per 100 superficial feet.	1s.	(e) Elm Hubs, with or without metal bands.
(D) Timber, undressed, being Oregon, in sizes of 12 in. x 6 in. (or its equivalent) and over, per 100 superficial feet.	6d. on and after 28th Feb., 1902.	(f) Engravers' Boxwood. (g) Logs, not sawn.
(E) Timber, undressed, n.e.i., in sizes of 7 in. x 2½ in. (or its equivalent) and upwards, and less than 12 in. x 6 in. (or its equivalent), per 100 superficial feet.	1s. 6d.	(h) New Zealand Pine, undressed.
(F) Timber, undressed, n.e.i., of sizes less than 7 in. x 2½in. (or its equivalent), per 100 superficial feet.	2s. 6d.; and on and after 28th Feb., 1902, 1s. 6d.	(i) Shafts and Poles, sawn or bent, but not dressed. (j) Spars in the rough.
(G) Laths, per 1,000	5s.	(k) Spokes, Rims, and Felloes of Hickory, in the rough.
(H) Palings, per 1,000	15s.	
(I) Pickets, dressed, per 100 ...	4s.	
(J) Pickets, undressed, per 100	2s.; and on and after Feb., 1902, 1s.	(l) Staves, undressed or roughly dressed, but not shaped.
(K) Shingles, per 1,000 . .	3s.	(m) Veneers.
Doors of Wood—		
(L) 1¾ in. and over, each .	7s. 6d.	
(M) Over 1½ and under 1¾ in., each ..	5s.	
(N) 1½ in. and under, each	3s. 6d.	
111. Wicker, Bamboo, Cane, or Wood—		(n) Bamboo, clouded.
(A) All articles n.e.i., made of, whether partly or wholly finished, including Bellows, Casks, Shooks, Sashes, and Frames, Timber (bent), n.e.i., Wood cut into shape and dressed or partly dressed for making boxes or doors, Walking Sticks and Canes, ad val.	20 per cent.	(o) Buckets, wooden. (p) Canes and Rattans, unmanufactured. (q) Cane, compressed, in sheet and unshaped. (r) Last Blocks, rough turned.
(B) Axe and other unattached tool handles, ad val.	20 per cent.; and on and after 14th Aug., 1902, 15 per cent.	(s) Lasts and Trees, wooden. (t) Wooden Type, Wooden Type Cases, and Type Cabinets and Cases.

I submit the following provisional classification of our timbers:—

Split or Cloven Timber—

Spokes—

Spotted Gum.
Apple (*Angophora*).
Ironbark.
Blackbutt.
See also "Wheelwrights' Timbers."

Rungs for Ladders

Ironbark.
Spotted Gum.

Tooth-picks and Skewers—

First-class woods for these purposes remain a desideratum. They should be sufficiently tough, should not splinter, must dress readily, be of a good colour, and be without taste.

Trenails (wooden pegs of different sizes).

I do not know the extent of this manufacture in Australia, nor the woods used.

Lead-pencil Woods—

Pencil cedar (*Juniperus Bermudiana*) is largely used for this purpose in Europe. The supply is falling short of the demand, and pencil-makers are searching for substitutes. I hope one of our Northern River timbers will be found suitable. The desiderata are:—

1. Very soft. Cannot be too soft.
2. Close-grained, *i.e.*, must not present an open appearance when cut.
3. Homogeneous.
4. Colour; a white wood will not do.
5. Must not be rare and expensive.

Palings and Weatherboards.

Tallow-wood.
Red Mahogany.
Stringybark.
Mountain Ash.
Cut-tail.

Palings are usually *sawn* in New South Wales for the larger towns, but most landowners split at least some of their palings.

Laths for plasterers' work.

The New South Wales timber used for builders' laths is principally Black butt, split into 3ft. lengths, but these are not used to any extent now, being superseded by Oregon sawn laths, and also by metal.

Roofing Shingles—

Grey Gum.
Red Mahogany.
White Mahogany.
Forest Oak and She-oaks generally.
Silky Oak.
Cudgerie.

In various districts almost any hard, free-splitting timber is used for the purpose.

Wood for string musical instruments—

This manufacture cannot be a large one, but the search for suitable timbers should be kept in view.

Cheese moulds.

Measures for fruit or dry goods.

Sieve-frames.

Drums.

Band-boxes--

Suitable timbers (tough and very free splitters) for all these purposes should be rendered available.

Coopers' Work.

It is understood that the lists which follow are quite tentative. A good deal of disappointment has been experienced in the use of Australian timbers for cooperage purposes by persons who are only too anxious to give them a fair trial.

One firm of coopers writes :—

"Our native timbers at present are very few, and then not any of them first-class that could take the place in the spirit, wine, and beer trade, and even for butter we have not a good timber on this continent."

Another says :—

"We chiefly manufacture Tallow casks, our total consumption of timber being at the present time 22,000 superficial feet per week. All the timber we use is imported by us from Puget Sound, America. When we happen to run short of this we substitute New Zealand Kauri and New Zealand White Pine."

A third writes chattily :—

"My experience reaches back half a century when timber was plentiful in the Illawarra district. I used almost all kinds to supply the settlers with their requirements in cooper-ware. I had a shop many years in Kiama, and had opportunity of testing all kinds for that purpose. Some answered very well for butter kegs and tubs. My impressions at that time were that colonial timbers answered their purpose, but would never come up to English Oak. I will mention a few of the timbers I used, although they will never come into general use for wine and spirit casks. They are far too heavy, too brittle, will not bend easily, and are liable to great shrinkage. The main point that is required for cooper work is lightness, must not be porous, must be nice or straight splitting. I will speak of a few that might do for tallow casks, butter kegs and tubs, &c.

"Flooded Gum makes very smooth and clean work, is a very substantial and lasting timber, but on account of being heavy, not suitable for casks in common use. It is indestructable in water for marine purposes.

"Beefwood.—I would prefer it to any other wood, is something in grain like English Oak. It lasts well and splits well, but for cooper-ware is too hard and too heavy, but is of a very nice red and beautiful colour. But of all timbers I handled the best went under the name of 'Long Jack.' It is light, close-grained, easily worked, and very suitable for cooper-ware in large or small work, and think would do for wine and spirit casks. But it will not split into staves, and can be used only in sawn boards altogether ; it is useful for all kinds of work, cabinet or railway carriages. I believe it is the finest timber in New South Wales if it could be procured in any quantity. It contains some kind of essential oil which prevents it from shrinking and warping. The late Mr. Francis Guy, who was about 3 miles out of Kiama, was a good expert on timbers. He supplied me with valuable information and even with staves, but he did not think much of colonial timber. He used a great deal of cooper-ware, and always preferred English Oak. I could mention most of the leading dairymen in Kiama district at that time, but none cared about colonial timber in their work. Now I will only mention the Honorable Captain Charles. He had a large dairy at that time, but he always preferred Oak, and paid 30 and 40 per cent. more on Oak kegs than on colonial wood, and this was the opinion of all leading dairymen. And at that time the dairymen sent their supplies to Sydney, and the kegs were sent back as empties, and oak could only stand the wear and tear. And in conclusion I may say even at that time considerable butter was exported to London in butter firkins of 100 lb. each, some were made of colonial timber and some of Oak ; and I heard it said that the butter sold more readily in Oak kegs than in colonial timber."

Spirit Casks —
- Rosewood.
- Silky Oak.
- Blackwood.

Wine Casks —
- White Ash or Mountain Ash.
- Blackbutt.
- Beech.
- Silky Oak.
- Rosewood.

Vats—
- Beech.

Butter-kegs —
- Silky Oak.
- Red Silky Oak or Beefwood.

Meat Casks—
- Bolly Gum.

Casks in General—
- Silky Oak.
- Red Silky Oak or Beefwood.
- Mountain or White Ash.
- Blackwood.
- Blue-berry Ash.
- Rosewood.
- Coachwood.
- Cudgerie.
- Red Ash.
- Bolly Gum.
- Yellow-wood (*Flindersia Oxleyana*).

Cask-heads.

Barrel Hoops.

[It would appear that these are but little made in this State.]

Timber used on, or in, the ground; also flooring, lining boards, and ceilings.

Foundations of Buildings —House-blocks—
- Rosewood.
- Cypress Pine.
- Woolly-butt.
- Grey Gum.
- Murray Red Gum.
- Red Mahogany.
- Swamp Mahogany.
- Ironbark.
- Turpentine.
- *Tristania suaveolens* (Swamp Mahogany of the Northern Rivers).

White-ant Resisting Timbers —
- Cypress Pine.
- Brown Pine.
- Red Mahogany.
- Teak.
- Brush-box.
- Red Cedar.
- Rosewood.
- Turpentine.
- Yellow Box.

Wood-paving—
- Tallow-wood.
- Blackbutt.
- Red Mahogany.
- Blue Gum.
- White Mahogany.
- Murray Red Gum.
- Forest
- Bloodwood.
- Turpentine.
- Brush Box.

Bridge-decking—

Tallow-wood.
Brush Box.
Red Mahogany.
White Mahogany.
Blackbutt.
Spotted Gum.
Murray Red Gum.

At p. 2 of a document entitled "Suitability of New South Wales Timbers for Railway Construction, published by the Government of New South Wales for the information of the Government of India" (compiled by R. Dalrymple Hay, Chief Forester, Department of Lands), the following paragraph occurs:—

"This State, which possesses extensive tracts of Ironbark, largely employs this fine hardwood for piles, beams, girders, and transoms of bridges on account of its great strength and durability, and Tallow-wood, Grey and Red Gum, Blackbutt, Sydney Blue Gum, and Stringybark for decking and light scantling, while for jetty and pier work Turpentine, Ironbark, and—to a less extent—Tallow-wood are used.

"The average life of these timbers naturally varies greatly, being dependent upon situation and climate, but a life of about forty years is recorded for Ironbark bridge timber."

Railway Sleepers—

Ironbark.
Grey Gum.
Blue Gum.
Murray Red Gum.
Forest Red Gum.
Blackbutt.
Red Box.
White Box.

The Railway Construction Branch of the Public Works Department includes more timbers in its official tender-list than was the case a few years ago.

The following is taken from page 3 of Mr. Hay's publication already quoted:—

"The following table shows, in order of merit, the average life of New South Wales sleeper timbers. This line material is usually cut from green trees, and is merely stacked for a short time in the forest or along the lines before being laid, but no preservative process is employed:—

Gauge.	Shape.	Timber used.	Life in Track.
4 ft. 8½ in.	Rectangular. Main lines—9 ft. x 10 x 5 in.; Branch lines—8 ft. x 9 x 4½ in.	Hewn Ironbark	25 years.
		,, Grey Gum	22 ,,
		,, Murray Red Gum	20 ,,
		,, Tallow-wood	20 ,,
		,, White Stringybark	18 ,,
		,, White Mahogany	18 ,,
		,, Grey Box	18 ,,
		,, Blackbutt	16 ,,
		,, Turpentine	16 ,,

"Railway sleepers in this State are principally cut from hollow over-matured trees, the shells of which contain remarkably sound timber. They are frequently laid in the track as soon as brought in; but, when stacked, the ends, where exposed to the sun's rays, are occasionally given a coat of paint, but no other protective steps are taken. The exposed surface of newly-hewn hardwood sleepers sometimes shows small irregular sun-cracks, but they seldom split when laid in the road."

See also a valuable report by Mr. James Fraser, Engineer-in-Chief for Existing Lines, given at page 8 of Mr. Hay's publication, but too long to reproduce here.

Mining Timber-

For the following useful notes in regard to timbers used in mines, I am indebted to Mr. R. H. Cambage, Chief Mining Surveyor :—

"For our purpose, and so far as New South Wales is concerned, mining may be divided into two classes, viz.:—Coal and Metalliferous. The latter includes gold, silver, copper, &c., while the former applies only to coal and shale.

A coal seam, being generally horizontal, is worked for miles right and left. Under the water and in dangerous places the coal is taken out in channels called bords, of about 6 yards wide, while pillars of coal, 8 yards wide, are left standing to support the roof. Under the land, the bords are often wider and the pillars narrower. But, in addition to these pillars, it is generally necessary, while the work is in progress, to still further support the roof immediately over the bords, and this is done by means of props the same length as the coal is deep—say, 5 to 7 feet. As the bords are opened out, the timbering begins, and consists in the first place of props, slabs, and caps. A slab about 6 feet long is placed against the roof and across the bord, and is supported by two props, the latter being selected of a length that will just about reach from floor to slab. As, however, it is difficult to pick up the exact sizes to fit tightly, a wedge of wood is driven in, if necessary, between the top of the prop and the slab. This wedge is called a cap-piece. After the bord is worked out, the whole of this timber, if still good, is removed and used again in another part of the mine, but generally is left to decay.

The slabs are split from Hardwood. The props are generally saplings, with a diameter of about 6 inches Hitherto they have been used with the bark on, but there is now a tendency to have them barked, in order to reduce the risk of fire. The trees used for props seem to be those which happen to grow handy to the pit, and are straight. In the Newcastle mines I have noticed Bloodwood (*Eucalyptus corymbosa*), Blue Gum (*E. saligna*), Spotted Gum (*E. maculata*), Grey Gum (*E. punctata*), Stringybark (*E. eugenioides*), Red Mahogany (*E. resinifera*), White Mahogany (*E. umbra*), and perhaps some others. One tree objected to at all the pits is locally called Red Gum. I find it is *Angophora lanceolata*. In one pit the Turpentine (*Syncarpia laurifolia*) is not used, but I cannot find the reason, so far. The local Peppermint (*E. piperita*) is also objected to. The Blackbutt (*E. pilularis*) does not grow close to Newcastle, or it would probably be used. It is common about Wyong. Out of the above lot the tree that would prove the quickest and most erect grower would probably be the best for planting, and would, I think, be the Blue Gum (*E. saligna*). *E. pilularis* should also be good. The former likes a good soil in a well-sheltered valley, and the latter prefers a soil somewhat sandy.

In metalliferous mines the reefs or lodes are generally more or less vertical, though inclined at all angles. The work is carried out by shafts being sunk on the reefs, and drives a few feet wide (in gold mines), following the courses. In copper and silver mines the lodes may be 20 or 40 feet wide. The shaft is timbered by sets of split hardwood slabs, except where the walls are of solid rock. The props are used generally to resist lateral pressure, and have to stay in position a long time, often in drives where the stratæ are inclined at an angle of, say, 30 degrees. It is therefore necessary that they should be of greater strength and better lasting quality than those used in a coal mine. Generally for slabs a fissile, local timber is selected—one that lasts fairly well in the ground. In a copper mine south of Oberon, the local Blackbutt (*E. regnans-fastigata*) is being used. West of the Great Dividing Range the red Stringybark (*E. macrorrhyncha*) is considered good for this purpose, and is a favourite for all mine work. Usually, each district makes the best of the local timbers. In the Burraga district the Bundy (*E. Cambagei*) is used for strong props, also the Red Box (*E. polyanthema*), but neither of these trees is a free splitter. In the interior, the Mallees (*E. oleosa*, *E.incrassata*, var. *dumosa*, &c.) are sometimes used, and for a dry climate the *large* forms of *E. oleosa* should be suitable. The nearest point to a railway, where seeds of the latter could be obtained from the large forms, would be five and a half miles north of Condobolin, along the Melrose Road. The other Mallees do not, as a rule, take the large form so much as *E. oleosa*. In colder climates a gum (*E. coriacea*) is freely used in gold mines, as it splits readily, and is by no means one of the worst timbers in the ground. The box timbers are all good, but miners always seem in a hurry, and prefer those somewhat softer. The forest Red Ggm (*E. tereticornis*) and the variety *dealbata* are used. In our mountain auriferous districts, I think the Stringybark (*E. macrorrhyncha*) is considered about the best all-round miner's tree."

Posts—

Ironbark.
Red Box.
Yellow Box.
White Mahogany.
Tallow-wood.
Red Gum.
Grey Gum.
Red Mahogany.
Bloodwood.
Turpentine.
Grevillea striata (Western Beef-wood).

Tram Rails—

Brush-box (North Coast).
Spotted Gum (South Coast).

Railway Keys—

Cedar.
Cudgerie.

Woods used in Forts—

"Pallisades in fortresses are made of all kinds of wood, chiefly coniferous. Platforms of guns and other parts of forts are made of all kinds of wood, chiefly oak and Scotch pine" (Schlich).

[Our forts are on a small scale, but it may be that in the early future they may be more numerous and on a larger scale than is deemed to be necessary at present. In the meantime experiments might be made as to the best New South Wales timbers for these and other military purposes.]

Flooring—

Tallow-wood.
Beech.
Colonial or Moreton Bay Pine.
Sassafras.
Teak.
Cudgerie.

[Baltic lining and flooring and New Zealand kauri are very largely used here.]

Ceilings, Lining Boards—

Cedar.
Beech.
Colonial or Moreton Bay Pine.
Cypress Pine.
Blue-berry Ash.
Sassafras.
Teak.

Wood used in contact with Water.

Piles, for Wharves (Teredo-resisting Timbers)—

Turpentine.
Prickly Tea-tree and other Tea-trees.
Brown Pine.
Red Mahogany.
Ironbark.

Well-slabs—

Teak.

Floats of Mill Wheels

Beech.
Mountain Ash.

Ship and Boat-building.

Boats

Red cedar is the timber most generally used for pleasure boats.

Planking—

Cedar.
Beech.
Cudgerie.

Oars—

Blue-berry Ash
Cudgerie.
Mountain Ash (Tumberumba, &c.).

[I am of opinion that the use of native timbers for these articles may well be considerably extended, particularly as we have a great length of coastline, and have many pleasure craft on our coastal rivers and estuaries.]

Ribs, Knee-pieces—

Prickly, White, and other Tea-trees.	Red and White Honeysuckle.
Mangrove.	Water Gum.
	Fig.

Mast and Spar Wood—

[Steel masts are commonly used for large craft; Oregon for small craft. I am not aware that native timbers are much used in New South Wales for even small craft.]

Woods used by the Coachbuilder and Wheelwright; Tool Handles, &c.

Construction of Carts, Waggons, and Wheeled Carriages generally—

Coachwood.	Red Cedar.
Rosewood.	Bolly Gum.
Plumwood.	Colonial or Moreton Bay Pine.
Beech.	Blackwood.
Brown or Bully Beech.	Mountain Hickory.

Railway Carriages (ornamental woods)—

Following are notes by Mr. W. Thow, New South Wales Chief Mechanical Engineer, on some ornamental New South Wales woods used for railway carriage building:—

"Rosewood is an ornamental timber, dense, strong, and durable, and is used sometimes in the interior work of carriages. It is found, however, that varnish and polish very soon deteriorate on this timber, and it is not suitable for large sizes, such as panels, in consequence of its liability to split.

"Black Bean is an ornamental timber, dark in colour, and has a grain something like Tasmanian Blackwood. It takes polish and varnish well, and retains its shape, shrinking very little in seasoning. It is found to be suitable for panelling and inside framing of carriage work.

"Silky Oak is a mottled ornamental timber, suitable for framing or small panelwork.

"Cypress Pine is also an ornamental well-figured timber; but it is not obtainable in large sizes, and is liable to knots. It is sometimes used for small panels in railway carriage work. In addition to the above, Blackwood and Red Cedar are largely used in railway carriage construction, the former for framing, and the latter for panels."

Railway Carriages and Trucks (frames, &c.)—

Ironbark.	Tallow-wood.
Spotted Gum.	Blackbutt.
Grey Box.	Red Mahogany.

Following are notes by Mr. W. Thow as regards railway carriage timbers in general:—

"The principal of these for the work are Ironbark and Tallow-wood. Both these timbers are strong and durable, and keep their shape in seasoning. The Ironbark, being heaviest, is used in cases such as brake-vans, where weight is desired; but for ordinary carriage and waggon under-frames, where timbers are used, Tallow-wood is preferred.

"Blackbutt, Sydney Blue and Spotted Gums, are similar timbers to Tallow-wood, strong and durable; but subject to shakes and gum veins, and they twist and shrink during seasoning. On that account they are considered inferior to Tallow-wood, and are only used for the least important parts of under-frames.

"Red Mahogany and Woolly-butt are also good timbers, but as they twist and shrink very much in seasoning, their use is principally confined to floor boards for waggons.

"White Beech is an excellent timber, but not so suitable where great strength is required. It is generally used for roof-ribs of carriages or vans, and some of the smaller details."

Wheels (Nave, Spokes, Felloes), Body-shafts, Framework, Panels.

Shafts and Poles—

Spotted Gum.
Mountain Ash.
Ironbark.
Grey Box.
Blackwood.
Mountain Hickory.

Heavy Dray Shafts—

Ironbark.

Felloes—

Blue Gum (sometimes called Woolly-butt).
Grey Gum.

Naves—

Ironbark.
Rosewood.
Red Bean.
Apple.
Spotted Gum.
Grey Box.

Ladders—

Cedar.

Cog-wheels (for Machinery)—

Teak.
Ironbark.
Tea-tree.

Bending Timbers—

Spotted Gum.

"It is to us as valuable as Hickory is to America. It is not so well known as Hickory, but is coming to the front rapidly." Bent into shafts, rims, and spokes.

Southern (Tumberumba) Mountain Ash is also a marvellous bending timber.
Blackwood.

Wood for Tools and Implements.

This includes such uses as plane-boxes, turning-laths, presses, joiners'-benches, mangles, handles of tools, &c. Framework of agricultural implements.

Planes—

Brush-box.
Plumwood.
Blackwood.

Mallets—

Yellow Box.
Forest Red Gum.
Water Gum.
Brush-box.
Pigeon-berry or Native Beech.
Plumwood.
Tulip-wood.
Mangrove.
Marble-wood.
Sydney Blue Gum

Mauls—

Swamp Oak.
Grey Box.
Yellow Box.
Ironbark (the best).
Water Gum.

Tool Handles—
Blackwood.
Pigeon-berry Ash.
Native Cherry.
Swamp Oak.
Brush-box.
Water Gum.
Grey Box.
Mountain Ash.
Spotted Gum.

Axe Handles—
Many Wattles.
Spotted Gum.
Mountain Ash.
Water Gum.
She-oaks.

Broom Handles—
Some Wattles.
Rosewood.
Beech.
She-beech.
Blue-berry Ash.
Spotted Gum.
Tallow-wood.

Whip Handles—
Various western Wattles.

Billiard Cues—
Timbers used (?)

Boring rods (artesian wells)—
Spotted Gum.

Articles used in Dairies and Cheese-making establishments—
Silky Oak.
Red Silky Oak or Beefwood.
Richmond River Pine for butter boxes.

Chair-work—
Rosewood.
Silky Oak.

Wire-mattress Frames—
Colonial or Moreton Bay Pine.
Rosewood.

Cigar-boxes—
Cedar.

Bee boxes—
Cedar.
Beech.

Packing-cases—
Colonial Pine.

"The Austral Timber Company, of Sydney, complain that a duty of 25 per cent. is insufficient to keep out the cheap Norwegian cases, made by very cheap labour and at low freights, and that any duty on New Zealand White Pine for butter-boxes or other cases would entirely cripple our business." (Newspaper report of evidence before Tariff Commission, 1905.)

Joiners' and Cabinet-makers' Work.

Joiners' Work in General—
Cedar is the most valued wood.

Shop Fittings—
Cedar.
Rosewood.
Pine (Richmond River).

Doors and Window-frames—
Red Cedar.
Pine.

Venetian Blinds and Shutters—

In giving evidence before the Tariff Commission, 1905, a Sydney firm stated that no New South Wales timber would do for laths. "Redwood is even better than Clear Pine." Perhaps there is room for investigation here.

Mantelpieces and Overmantels –

Cedar.
Beech.
Blue Fig.
Bastard or Fig Beech for cheaper lines.
Coachwood.

Furniture and Indoor Fittings—

Red and Black Bean.
Blackwood.
Rosewood. "Is taking the place of Mahogany."
Silky Oak.
Red Cedar.
Onion-wood.
White Ash.
Tulip-wood.

Cheap Furniture—

Colonial Pine.

Cabinet-making—

Cedar.
Blackwood.
Black Bean (not often).

Piano Frames—

Black Bean.
Red Bean.
Rosewood.

Parquetry—

Beech.
Cudgerie.
Blue Gum.
Red Mahogany.
Silky Oak.
Red Silky Oak.

I believe we have many timbers suitable for this purpose.

Veneers —

She-oak.
Tulip.
Figured Black Bean.
Musk (root-stock).
Honeysuckle.
Silky Oak.
Red Silky Oak or Beefwood

Brushes (Backs of)—

Tulip-wood.
Forest Oak.
Silky Oak.
Maple.
Musk-root.

Picture Frames—

Plain—
Beech.
Blue-berry Ash.
Mountain Ash.

Figured or Coloured Timbers—
Honeysuckle.
Blackwood.
She-Oak.
Silky Oak.
Red Silky Oak.

In various parts of the State one is struck with the remarkable variety of the woods used for picture-frames, not only by carpenters and other

frame-makers, but by amateurs. There is a very strong feeling amongst many people that Australian pictures, certificates, &c., should be framed in Australian woods. Every district has its own woods suitable for the purpose, and it would be impossible to enumerate the whole of them. I have contented myself with a few that I have personally tried, and which can be obtained in the Sydney market. So far as I am aware, these woods must be obtained from the timber merchant and be cut to order, which shuts out their use from the small consumer. The time will come when an enterprising picture-frame maker will stock Australian picture-frame "mouldings," just as he does those cheap and attractive imported mouldings which are so common.

Wood-carving and Cognate Uses.

Carving—

White Holly, and *Pittosporum* in general.	Long Jack.
Cheesewood.	Rosewood.
Coachwood.	Plumwood.
White Teak.	Black Bean.
Native Orange.	Cedar.
Scrub Hickory.	Beech.
Soapwood.	Brown Pine.
Corkwoods (*Dubosia myoporoides*, white, and *Ackama Muelleri*, pink).	Colonial, or Moreton Bay Pine.
	Native Guava.
	Ivory Wood.

Doubtless there are many other timbers used, and more or less satisfactorily, for carving purposes. Wood-carving, as an "accomplishment" and as a useful art, is rapidly increasing in popularity, and for many years past I have pleaded with users to try our native woods. Much of our native timber is thus being employed, and valuable technical information is thus being amassed. I trust that experimenters will not keep the information to themselves. The difficulty of obtaining native woods to name, and in small quantities, is rapidly passing away.

Coarse Wood-carving—

This includes bowls or plates, platters, corn-meal and bakers' shovels, kitchen-rollers, milliners' blocks, milk-ladles, wooden spoons, shoemakers' lasts, saddle-trees, &c.

Sheaves and Blocks—

Water Gum.	Blackwood.
Beech.	Mountain Hickory.

Bullock Yokes—

River Oak.	Hickory or Black Wattle.
Swamp Oak.	Mangrove.
Brush Box.	White Honeysuckle.

Saddle-trees—

Teak.

Gun Stocks—

Cherry.
Blackwood.
Mountain Hickory.
Coachwood.
Maiden's Blush.

Forest Oak (*Casuarina torulosa*), should be suitable for rifle-stocks—heavy for shot-guns. As a rule, She-Oaks are unsuitable for stocks, on account of their fissile nature. Exception may be made in the case of those timbers used for bullock-yokes.

Tobacco-pipes—

Needle-wood.
Myall.

Engraving (bold outlines only)—

Cheesewood (softer and tougher than Turkey Box.)
Native Cherry.
Grey Myrtle.
Marblewood (*Olea paniculata*).
Wild Lemon.
Brush Ironbark, and perhaps other timbers belonging to the *Rutaceæ* and *Sapindaceæ*.

The "process" work for the multiplication of artistic illustrations has almost destroyed the demand which existed, a few decades ago, for engraving timbers.

Children's Toys—

Very few toys are made in Australia.

Cricket-bats—

Black Pencil Cedar.

Willow is, of course, largely used for this purpose in Europe. I think there is room for inquiry to see if any New South Wales woods also fill the requirements.

Turnery.

Turnery (Overmantels)—

She-Oak, especially Forest Oak.
Rosewood.
Blackwood.
Black Bean.
Marblewood.
Tulip, and many other timbers.

Turned Legs ; Table-legs—

Cedar.
Red Bean.
Black Bean.
White and Brown Beech.
Colonial Pine.
Sassafras.
Coachwood.
Mountain Ash.

Newels and Balusters of Stairs—

Cedar.

Verandah Columns—

Beech.
Blue Gum.
Spotted Gum.
Blackbutt.
Tallow-wood.

Large Wooden Screws—

Rosewood.
Swamp Oak.
Water Gum.
Plumwood.
Native Cherry.
Grey Box.

Jaws of Screws—

Brush Box.

Skittles—

Spotted Gum.
Blackwood.

Bowls (for playing)—

Myall.

Billiard Balls—

Myall.

Musical Instruments, such as Flutes, Fifes, &c.—

Myall.

Reels—

In very little demand at present.

Walking-sticks—

(*a*) Whole Plant—

Tee Trees.
Dwarf Palms (Mitchinbills or Walking-stick Palms).
Native Cherry.
Oaks.
Honeysuckles.
Wattles.
Cypress Pines.
Brush-box.
Sweet Root and very many others.

(*b*) Cut out of solid—

Blackwood.
Yarran (ringed or plain).
White Honeysuckle.
Forest Oak.
Tulip.
Cabbage Palm, and very many others.

Cask Taps—

I do not know if these are made in Australia at present.

Wood-pulp and Sawdust.

Wood-pulp—

Experiments are desirable as to the adaptability of our timbers for use as wood-pulp not only for the manufacture of paper, but also for various moulded articles which are made of it in the northern hemisphere.

Sawdust—

Used in Europe in stables; for packing; illuminating gas.

(*To be continued.*)

Hawkesbury Agricultural College and Experimental Farm.

STACK ENSILAGE.

H. W. POTTS.

The present sequence of good seasons emphasises the urgency for making provision for the inevitable periods of drought with their concomitant evils and scarcity of fodder.

To conserve fodder and render it capable of remaining edible for a number of years, and to make us independent of weather conditions, should demand more than passing attention.

In continuation of the records of a crop of sorghum grown at the College Farm, and appearing in the June number of the *Gazette*, 1905, the present article is written, for the purpose of giving the details of its conservation, and the results obtained from stacking it as ensilage.

The first consideration, after having determined to select the stack as a means of conserving the crop, is to secure a site in close proximity to the milking or feeding sheds. An elevated spot is best, with natural drainage and a firm dry surface layer of soil to start on, and, if possible, sheltered from prevailing winds.

It is essential to surround the stack with a fence sufficiently substantial to prevent stock of any kind reaching the fodder. Without this, calves, pigs, horses, and cattle are always attracted; they draw out stalks all round to get at the edible portion, and by this means admit air to the stack, check the fermentative changes, and spoil it for fodder.

Our previous experience in stack building was acted upon, and we again determined to abandon the somewhat cumbersome and expensive methods usually adopted of weighting, or the application of mechanical pressure.

With this in view, it necessarily involved throughout the need for careful stacking, and a dexterous manipulation of the sheaves in laying and cross-laying them alternately, and in such a way as to secure the closest system of packing.

Apart from the object of excluding and getting rid of entangled air, the danger to obviate was the opening up of the stack through uneven settlement and shrinkage during the fermentative processes later on.

It is of the utmost importance to build each layer evenly and upwards, maintaining a regular and unbroken contour, to ensure an equal distribution of weight, so that the stack will shrink evenly and maintain its shape. The main principle to observe in all cases is to keep out the air, and to obstruct its ingress during the curing stage.

The crop was cut and brought in quickly, and stacked by hand. The stage at which it was cut was when the panicle was full of well-coloured and

Ensilage Stack Early in May, 1905 Building

completely formed seed. The plant at this stage contains the largest amount of nourishment, and the minimum quantity of water.

Ensilage Stack, nearly Finished.

On completing the stack, the aim was to shape the roof so as to exclude rain and be kept intact, and resist wind. No thatching was designed or

special material utilised. The sheaves of sorghum were laid transversely, and when the ridge was reached, the whole was kept firmly in position by passing

Ensilage Stack, Finished. 13 May, 1905.

fencing wire across every four feet, and secured on each side to heavy fencing posts hanging loose. In this way, as the stack fell, and shrinkage set in, the

Ensilage Stack, showing Shrinkage. 26 July, 1905.

fencing posts hugged the stack closely, and kept the wires tight, and in close position until the whole mass condensed, becoming solid and stationary.

Shrinkage had ceased. From this out apprehension as to its condition ended.

It was approximately estimated that 150 tons of green sorghum were dealt with.

The following measurements were recorded six weeks after the completion of the stack.

	ft	in.
Average length of stack	27	6
,, width ,, . . .	20	0
Height from ground to eaves .	11	0
,, ,, ,, ridge	18	0
Length of ridge	24	0

From these the following volume was computed :—

		Cubic feet.
Volume below eaves—		
$27 \cdot 5 \times 20 \times 11$ .. .		6,050
Volume above eaves—		
Area of base, $27 \cdot 5 \times 20$ ...	550	
$4 \times$ (mid. area) $(27 \cdot 5 \times 24) \times 20$	1,030	
Area at top, 24×0 .	0	
	$1,580 \times \frac{7}{6}$ =	1,844
Total volume		7,894

A rough estimate of 40 lb. per cubic foot being accepted the total weight of the stack would be 141 tons.

At the end of January 1906, this stack was re-measured when curing was complete :—

	ft.	in.
Average length .	26	9
,, width ...	19	6
Height from ground to eaves .	8	6
,, ,, ,, ridge .	11	6
Length of ridge	24	0

Thus :—

		Cubic feet.
Volume below eaves—		
$26 \cdot 75 \times 19 \cdot 5 \times 8 \cdot 5 =$		4,434 (Nearly).
Volume above eaves—		
Area of base, $26 \cdot 75 \times 19 \cdot 5$ ...	$521 \cdot 6$	
$4 \times$ (mid. area) $(26 \cdot 75 \times 24) \times 19 \cdot 5$.	$989 \cdot 6$	
Area at top, 24×0	$0 \cdot 0$	
	$1,511 \cdot 2 \times \frac{3}{6}$	755 (Nearly).
Total volume		5,189

The stack was opened shortly afterwards, and as the centre was approached on February 5th, measurements were again taken to ascertain approximately the waste.

It was decided to allow for waste :—

18 inches all around the stack or the sides.
12 ,, over the top or roof.
6 ,, for the floor or bottom.

ENSILAGE STACK, JUST BEFORE OPENING. 1 FEBRUARY, 1906.

STACK OPENED.

ENSILAGE STACK. VIEW OF OPEN CUT FACE, SHOWING EVENNESS OF LAYERS AND UNIFORM COMPRESSION.

This reduced the measurements of available fodder, or good ensilage, to:—

Length ...		23·75 ft.
Width ...		16·5 ft.
Height from ground to eaves ...		7 feet
" " " ...		10 "
Length of ridge ...		21 "
Volume below eaves—		cubic feet.
23·75 × 16·5 × 7 ...		2,743
Volume above eaves—		
Area of base, 23·75 × 16·5 ...	391·875	
4 × (mid. area) (23·75 × 21) × 16·5 ...	738·375	
Area at top, 21·0 × 0 ...	0·0	
	1,130·25 × $\frac{1}{2}$ =	565
Total volume ...		3,308

The exact weight per cubic foot was next determined, by carefully cutting out a cube, measuring, and weighing it; *i.e.* the cavity from which the cube was removed was measured, and the cube weighed. This gave:—

Contents of cube ...	6·925 cubic feet.
Weight of cube	328 lb.
Weight of 1 cubic foot ...	47·37 lb.

Using this weight per cubic foot, the total weight of the cured ensilage was

5,189 cubic ft. × 47·37 lb. = 245,803 lb. = 109¾ tons nearly.

Deduct the waste on the top, sides, and bottom, and we have—

3,308 cubic ft. × 47·37 lb. = 156,700 lb. = 70 tons nearly.

An examination of the waste on the bottom of 6 in. showed that whilst the fodder was not equal in standard value to the other for milk cows, yet it is readily eaten by dry stock, and hence 2¾ tons may be added to the total edible silage, bringing the total to 72¾ tons.

The actual loss in food material from waste is thus noted from 109¾ tons to 72¾ tons, or a waste of 37 tons.

The loss of moisture in the curing stage being the difference between 141 tons and 109¾ tons, or 31¼ tons.

There is no difficulty experienced in cutting the silage with the ordinary hay knife.

The illustrations point to the straight, easily-cut material.

We have fed it to cows in full milk, in combination with lucerne hay and bran, the ration being—

40 lb. ensilage; 15 lb. lucerne hay.

or—

40 lb. ensilage; 12 lb. lucerne hay; 2 lb. bran.

The cows eat this freely, and relish it. The milk-flow is fully maintained.

It may be mentioned that in utilising stack ensilage, in comparison with chaffed ensilage conserved in a tub silo, the advantages are much in favour of the latter; but it often happens that convenience, time, and opportunity demand that stack ensilage shall be the means of conserving a crop.

It may also be pointed out that the larger the stack the less the waste, and hence it is more economical.

A saving may also be effected in carriage. A stack silo can be made in close proximity to a crop, and, when needed, the stock can be fed direct from it.

A stack may be made of any size and so can be built to suit the amount or weight of the crop.

Monthly Weather Report.

HAWKESBURY AGRICULTURAL COLLEGE.

Summary for January, 1906.

Air Pressure (Barometer). Lowest.	Highest.	Mean.	Shade Temperature. Lowest.	Highest.	Mean.	Mean for 13 years.	Air Moisture (at 9 a.m.) Saturation = 100. Lowest.	Highest.	Mean.	Evaporation (from Water Surface). Most in a Day.	Total for Month.	Monthly Mean for 8 years.	% of the year's Evaporation.
29·69 24th.	30·29 2nd.	30·02	52·8 3rd.	112·6 24th.	72·806	73·679	40 24th	88 8,9,19	70 2	·347 24th.	in. 5·668	in. 5 8	12·6

Rainfall (as recorded).	Dates	1	2	5	8	9	10	12	13	14	22	26	29	Total,	Mean rainfall for 14 years
	Points..	45	3	1	7½	20	4	60	5	25	5	53	2½	231 points.	297 points.

	N.	N.E.	E.	S.E.	S.	S.W	W.	N.W.
Wind	0	22	1	3	8	1	1	2

Thunderstorms on dates—13-25.

Greatest daily range of Temperature, 49·9 on 24th.

Extremes of Rainfall, 0 835 in 1904; 10·425 in 1895.

Days on which Shade Temperature rose above 90° Fahr —97·2 on 4th, 100 on 7th; 90 on 11th; 98·6 on 19th; 107 on 20th; 101 on 23rd, 112·6 on 24th; 94·9 on 29th; 90·5 on 30th, 93·4 on 31st.

Remarks.—A dull month, much air moisture present.

CHAS. T. MUSSON,
Observer

Summary for February, 1906.

Air Pressure (Barometer). Lowest.	Highest.	Mean.	Shade Temperature. Lowest.	Highest.	Mean.	Mean for 13 years.	Air Moisture (at 9 a.m.) Saturation = 100. Lowest.	Highest.	Mean.	Evaporation (from Water Surface). Most in a Day.	Total for Month.	Monthly Mean for 8 years.	% of the year's Evaporation.
29·91 14th.	30·32 19th.	30·09	52·6 6th.	101·7 17th.	73·225	72·218	56 6, 22.	100 14th.	73	0·254 7th.	in. 4·629	in. 4·527	10·3

Rainfall (as recorded).	Dates	2	12	14	17	19	20	24	25	26	28	Total,	Mean rainfall for 14 years.
	Points	2	8	8	15	21½	8	$\frac{1}{10}$	$\frac{1}{10}$	3	5½	$71\frac{2}{10}$ = 71·2 points.	223 points.

	N	NE	E	SE	S	SW	W	NW
Wind ...	0	16	1	5	6	0	1	0

Thunderstorms on dates—11th, 16th, 17th, 18th.

Greatest daily range of temperature, 43·6—6th.

Extremes of rainfall—$\frac{0·120}{1900}$ $\frac{6·118}{1895}$

Days on which shade temperature rose above 90° F.—$\frac{6}{96·2}$ $\frac{11}{97·1}$ $\frac{15}{92·3}$ $\frac{16}{98·5}$ $\frac{17}{101·7}$ $\frac{18}{97·6}$ $\frac{21}{94}$ $\frac{22}{96}$

Remarks:—A dull month. Dry. Temperatures about average.

CHAS T. MUSSON,
Observer.

Sheep at Wagga Experimental Farm.

G. M. McKEOWN.

PRIOR to the end of 1900, the work in connection with sheep consisted of purchasing store stock, and fattening them for market, all of the operations proving very profitable.

In 1900, the first ewes for breeding lambs for market were obtained; but it was not possible to procure sheep of the class required, a mixed flock of various ages and types having to do duty for the season. The results, however, were financially satisfactory, but not so instructive as those obtained during succeeding years from ewes of more uniform type and age, and of a more satisfactory class in other respects.

In 1901, 500 Lincoln-Merino ewes having large frames and robust constitutions were purchased at 11s. per head, and a large number of these are still in the flock.

The following year a small addition to the flock was made by selection from a number of full-mouthed ewes, which had been purchased for fattening at 8s.

In 1903, a purchase was made of 190 cross-bred ewes of similar type, but younger, at 15s. each.

Each year all broken-mouthed ewes have been culled and fattened for the supply of mutton to the farm, their value always bearing a substantial increase on the prices paid for them.

The returns shown herein, however, include only the earnings of the ewes from the sale of lambs and wool in each year. All items on both sides, in the last year, are here furnished as a specimen account.

Rent of land and interest on purchase money are not included, as every landholder is fully aware of the capital value of his own freehold, or the actual rental of his leasehold, and its carrying capacity.

In all cases the stock and wool have been sold by agents, and the net proceeds credited to the accounts, while all charges, except rent and interest, are included in working expenses.

The net earnings, therefore, are as follow:—

	£	s.	d.
1902.—500 ewes	219	12	0
1903.—539 ,, ...	419	6	3
1904.—646 ,, ..	460	6	8
1905.—503 ,, ...	435	18	4

Rainfall in 1902 was 875 points—January 1, to end of November.

The following are the items of 1905 account, viz.:—

Receipts—	£	s.	d.	*Expenses*—	£	s.	d.
By 440 lambs	244	14	6	To wages	30	2	1
,, 39 lambs on hand ...	22	16	0	,, freight on wool ...	9	6	8
,, wool for exhibits ...	5	8	4	,, packs, poison, salt, and sundries	7	5	6
,, sale of wool	209	13	9				
	£482	12	7		46	14	3
				Balance	£435	18	4

The rams used throughout were Shropshires, which were placed with the ewes in the month of November, in the proportion of 2 per cent., which has produced a very even lambing. The rams have not always worked well when first run with the ewes; but the difficulty has soon been remedied by yarding the flock at night for a couple of weeks.

The lambs have chiefly been dropped in May and June, sometimes a few having come in April. The greater proportion, however, have usually been dropped in about the one fortnight, the stragglers being few. Lambs have usually been sold in October or November.

Shearing is recommended, unless early arrangements are made for sale and delivery, so as to lessen the risk of loss of condition by grass seeds, which, after October, are very troublesome. The price obtained on the farm in last November was 11s. 6d. for shorn lambs, a few seconds going to the same buyer at 10s. 6d. Some of the sheep bred each year are kept on the farm for demonstration purposes, and, after last shearing, the dressed weight of a 6-tooth wether was 153 lb., while a 2-tooth wether dressed at 83 lb. A small lot of 2 and 4-tooths, of mixed sexes, at last shearing averaged 11½ lb. of wool.

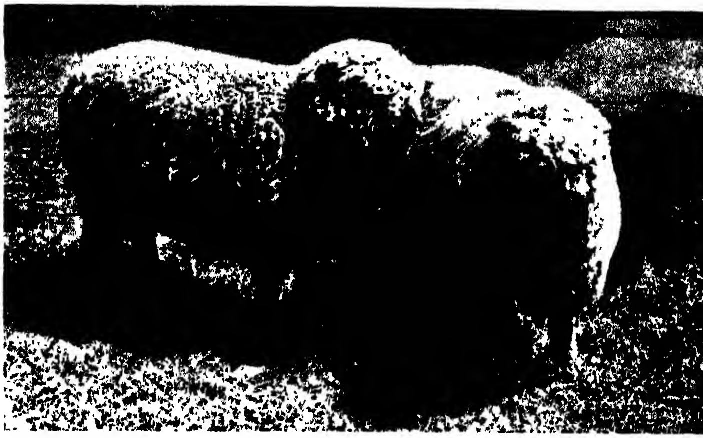
In order to secure the best results, it will be found desirable to give the ewes attention at lambing time, so as to assist those which require it, thus securing them and their lambs from the attacks of crows.

Systematic baiting for dogs and foxes should be carried out. It will be found a good plan to run a drag round the paddock consisting of a good-sized piece of meat which has been slightly roasted. On the trail thus made, pieces of meat or liver, or birds which have been treated with strychnine should be dropped at intervals, and all dead lambs should be poisoned for the same purpose. It is supposed by many that foxes will not take baits which have been handled in the preparation, but our experience has proved the contrary.

All sheep available are turned on to stubbles or fallowed land, as they perform valuable service in cleaning up fallen grain, and, to some extent, fertilising the soil, while removing weeds and other matter which would later become a source of trouble but for their agency.

When fertilisers are used for wheat, and the land is allowed to return to grass each alternate year, the carrying capacity is considerably increased, and, for a certain period, evidence of this has been apparent on the farm.

In a good season, a 300-acre paddock has carried 1,400 sheep and lambs for five months, without clearing off the grass, and in a later year, sufficient stock were not available to feed it off, and a considerable quantity was cut for ensilage. It was, however, impossible to secure the whole of it, owing to the short duration of the cutting season. Part of the paddock recently returned



SHROPSHIRE EWES.

SHROPSHIRE EWES AND LAMBS.

LAMBS BY SHROPSHIRE RAMS FROM LINCOLN-MERINO EWES.

LAMBS BY SHROPSHIRE RAMS FROM LINCOLN MERINO EWES.

TWO-TOOTHS BY SHROPSHIRE RAM FROM LINCOLN-MERINO EWES

FOUR-TOOTH CROSS-BRED WETHERS BY SHROPSHIRE RAMS FROM LINCOLN-MERINO EWES.

3 tons of wheaten hay per acre. The question as to how long the re-seeding of the paddock will continue cannot, of course, be decided yet.

The breeding of lambs for freezers or for consumption in our own State is receiving much attention throughout Riverina, and all who have started on right lines are well satisfied with the results.

Shropshire Ewes.

It is sometimes argued that the present prices of sheep are abnormal, and that the industry will, in due course, cease to pay ; but even when prices are lower it should be borne in mind that the value of a lamb will bear the same proportion to that of its dam as under present conditions, and that it will then be possible to stock a run more in accordance with its carrying capacity than is possible with ewes at present prices.

Border-Leicester Rams.

In addition to the Shropshire, other rams, viz., Lincoln and Border-Leicester, are being used this year, and comparisons also will be made of the lambs from merino ewes with those from cross-bred ewes by these rams.

Shropshires.

A Shropshire stud flock was first started at the farm early in 1902, the first ram purchased being Royal Ruler II - a winner of a second prize at the Melbourne Royal Agricultural Society's Show. This ram was bred by Mr. T. J. Burbury, of Tasmania, and some excellent stock has resulted from his use.

The rams at present in the flock are Strong Rose, bred by Mr. A. E. Mansell, and Prince d'Or, by Rosador, bred by Mr. T. J. Burbury. Both of the latter won prizes at Sydney and Melbourne respectively. Among the ewes are a number by the well-known sires Stars and Stripes, Balaklava Hero, Rose Stock, Roxburgh Prince, Champion Alick's Choice, Champion Royal Blood—the latter a winner of an English Royal Championship.

The breed has proved itself hardy and admirably adapted to our conditions, which at times during the last few years have been severe, and especially so in 1902, when the rainfall was the lowest recorded for many years.

Lime-burning.

In answer to a correspondent, Mr. F. B. Guthrie, chemist to the Department, supplies the following information *re* lime-burning:—

"Many forms of limekilns are in use, but they are reducible to two types: (1) That in which the limestone is in contact only with the products of combustion, being separated from the fuel itself and known as 'burning with long flame,' and (2) that in which the limestone and fuel are mixed or 'burning with short flame.'" The former yields cleaner lime, as it is not contaminated with ash, while the latter is more economical of fuel and can be adapted for continuous running; the kilns are usually of the form of an inverted cone, and are packed with alternate layers of limestone and fuel, the burnt lime being removed through openings at the bottom. The process can be carried on continuously, charging at the top and unloading beneath by proceeding regularly. Two such kilns with a capacity of 1,200 cubic feet furnish on an average about 250 bushels of lime per day. The proportion of fuel (coke) to limestone is about one of fuel to four of stone; in place of coke, wood can be used, the proportion of fuel to stone being then a little higher; the product (quicklime) is rarely more than 50 per cent. of a given weight of limestone dealt with in the kiln, though, in theory, the yield should be 56 per cent. With a good deposit of limestone and intelligent supervision of burning operations there should be no special difficulties in producing good lime.

Experiments with Oats at the Wagga Experimental Farm, 1905.

A. S. WALTON.

As the experiments with oats at this Farm for the last three years have been so successful, the following notes are of interest. Of course there are few varieties suited to the district, still those few in heavy type should receive the attention of growers of oats. Of all the varieties imported and grown here not any have reached the standard of the Algerian, Rust-proof, and Dun, as far as hay-making qualities are concerned. For grain, of course,

Harvesting Oats, Experimental Plots, Wagga, 1905

the white oats are preferable. April, there is no doubt, has proved to be the best month here for the sowing of oats—that is, of course, if good rains come along early enough to allow of ploughing, &c., and as a rule they do. Fallowing for oats will at all times be found advantageous in their cultivation, as well as that of other cereals.

The following varieties were tested, under uniform conditions, to gain information regarding their relative yields, earliness, and other qualities. They were sown on the 17th and 18th of April, in a sandy loam of granitic origin, with clay subsoil, which had been lying fallow twelve months. The ground was ploughed 4 inches deep, as soon as possible after previous crop, which was oats, was taken off, and during summer months worked up with

cultivator to keep weeds down, and shortly before sowing ploughed again 6 inches deep with double-furrow mouldboard plough, and harrowed twice, which left it in fair condition. The seed was drilled at the rate of half a bushel per acre, which is sufficient for grain. For hay a bushel is needed, and drill sowing is recommended. The manure used on this occasion was superphosphate, sown with the same drill at the rate of 60 lb. per acre :—

Variety.	Area.	Date of Sowing.	Date of Germination.	Date of Ripening.	Average length of Straw.	Yield of Grain per Acre.	Yield of Straw per Acre.	Rainfall.	Remarks.
	ac.				ft in.	bus. lb.	ton cwt qr lb	Points	
Skinless . ..	½	18 Apl.	26 Apl.	27 Nov.	5 0	41 5	3 13 3 16	Jan., 1·27	Coming out in head, 7/10/05 ; straw very fine; a little rust on flag.
Danish Island	½	18 ,,	25 ,, .	4 Dec.	5 6	62 32	3 9 2 13	Feb., ·92	Coming out in head, 11/10/05; straw coarse; rust on flag
Salzer's Silver Mine.	½	18 ,,	25 ,,	4 ,, .	6 0	65 22	3 11 0 16	Mar, 17	Coming out in head, 9/10/05; straw coarse; rust on flag.
Salzer's Big Four	½	18 ,,	25 ,,	4 ,, .	6 0	75 22	3 3 0 14		Coming out in head, 9/10/05; straw coarse, a little rust on flag.
Storm King ..	½	18 ,, .	26 ,, .	11 ,, .	5 0	47 7	4 7 2 3	April, 2·09	Coming out in head, 13/10/05; straw very coarse; rust very plentiful on flag.
Tartar King ..	½	18 ,, .	26 ,, .	11 ,, ..	5 0	46 34	4 5 0 23	May, 1·65	Coming out in head, 13/10/05; straw very coarse; rust very plentiful on flag.
White Oat of Ligomo.	1	18 ,, .	23 ,, .	30 Nov	6 6	74 5	3 0 1 17	June, 3·73 July, 2·73	Coming out in head, 7/10/05; straw medium, odd specks of rust on flag.
Great Northern..	1	17 ,, .	25 ,, ..	4 Dec.	6 0	59 24	2 15 3 26	Aug., 1·06	Coming out in head, 14/10/05, straw medium; rust on flag.
Gold Finder .. .	1	17 ,, .	25 ,,	7 ,, .	5 0	59 39	3 1 0 17	Sept., 1·62	Coming out in head, 16/10/05; straw coarse; rust plentiful on flag and a little on stalk.
Abundance	1	17 ,, ..	25 ,,	4 ,, .	6 0	66 6	2 11 0 10	.	Coming out in head, 14/10/05; straw rather coarse; rust on flag and stalk.
Colossal . ..	1	17 ,, .	25 ,, .	4 ,, ..	6 3	39 34	3 0 3 15	Oct, 3·35	Coming out in head, 16/10/05; straw rather coarse, rust on flag.
Rust-proof ..	1	17 ,, .	25 ,, ..	27 Nov.	6 0	54 30	2 10 2 16	Nov., nil.	Coming out in head, 3/10/05; straw fine; a little rust on flag
Algerian	1	17 ,,	25 ,,	27 ,,	6 0	44 28	2 8 0 12	Dec, ·95	Coming out in head, 3/10/05, straw fine, and very little rust on flag.

It will be noticed in the above table that "Big Four" this year has attained the highest yield ; the grain, which is white, short, and plump, may be freely recommended, but as far as the straw is concerned it stands low in this district, being too coarse. Next on the list comes "The White Oat of Ligomo," which, apart from its grain-producing qualities, possesses a straw a little coarser than Algerian, still not too coarse for hay.

Oats should be cut before they are dead ripe, and allowed to mature in the stack. If the straw be well secured, that is without injury from rain, it forms good food for stock—superior to either wheat or barley.

Wheats Grown at Bathurst Experimental Farm, 1905.

R. W. PEACOCK.

	Variety.	Previous Crop.	Area.	Date Sown.	Seed Sown per Acre.	Date Harvested.	Yield per Acre.	Rainfall during Growth.	Rainfall for Year.	No. of Paddock.
			acres	1905.	lb	1905.	bus lb	inch	inch.	
Comparable.	Federation	Rape	2·49	24 Apl.	28½	21 Dec	37·30	15 64	18·57	12
	Cleveland	,,	1 73	19 ,,	28¼	23 ,,	35·3	15 64	18·57	12
	Rymer	,,	·94	20 ,,	28⅛	19 ,,	31 50	15 64	18·57	12
	Schneider	,,	4·77	20 ,,	28¼	20 ,,	29·59	15·64	18·57	12
	Tarragon	,,	1 68	19 ,,	28½	21 ,,	29·18	15·64	18·57	12
	White Hogan	,,	1·82	22 ,,	28¼	22 ,,	26·50	15 64	18·57	12
	John Brown	,,	1·78	18 ,,	28¼	20 ,,	25 0	15·64	18 57	12
	Power's Fife	,,	1·67	13 ,,	28½	21 ,,	24 40	15·64	18·57	12
	Steinwedel	,,	1·43	18 ,,	28½	14 ,, / 21 ,,	23·44	15 64	18·57	12
	Bobs	,,	3 72	26 ,,	28⅛	19 ,,	19 7	15 64	18·57	12
	,,	Bare fallow	3·55	8 ,,	28	20 ,,	29 7	15·64	18·57	2
Strictly comparable.	Bobs	Cow-peas	3·40	8 ,,	28	20 ,,	25·11	15·64	18·57	2
	Steinwedel	,,	3·13	10 ,,	29¾	22 ,,	26·48	15·64	18·57	2
	Schneider	,,	3·17	10 ,,	26¼	22 ,,	25·30	15·64	18 57	2
Not comparable with each other.	Bobs	Oats and wheat	5·50	20 May	29½	22 ,,	28·12	11 90	18·57	5
	Steinwedel	Wheat	10·50	8 June	32	27 ,,	19 8	8·51	18·57	4
	H. E. P., Straw	,,	13·0	12 May	30	27 ,,	17·15	9 97	18·57	6
	Bobs	Bare fallow	18·0	16 Mar.	30	16 ,,	9 40	15·64	18·57	20
	,,	Wheat	63	7 Apl.	30	12 ,,	24·48	13·95	18·57	7

NOTE.—Average yields per acre of the Farm, excluding paddock No. 20 (eaten off twice by sheep), 22 bushels 27 lb.
Gross yield from 82$\frac{9}{10}$ acres, including paddock No. 20, 1,634 bushels.

NOTES.

THE following are the monthly rainfalls throughout the year:

January	·86	May	3·44	September	1·39
February	1·54	June	1·73	October	2·84
March	1·31	July	1·67	November	·35
April	2·20	August	·81	December	·43

Total—18·57 inches.

This rainfall, following as it did a similarly low rainfall of 1904, viz., 18·26 inches, proved inadequate to give the best results.

Owing to the exceptionally backward season, November and December proved critical months, and the falls during these months were not sufficient. Notwithstanding this, the wheats filled well, and the sample proved superior to that of last season.

Paddock No. 12 was devoted to the testing of the yields, &c., of many of the new, with a few of the more generally known varieties. It had received similar treatment throughout, as far as was practicable, having been cropped previously with rape for depasturing sheep. This paddock is one of the poorest on the farm, and the results, as given above, demonstrate the success of the systems of rotation and culture followed.

The first eight (8) varieties are comparable, after making allowance for a few patches in both Tarragon and John Brown. These were due to a portion of the area having been used for stacks in the previous working of the paddock. The loss to each variety has been computed at about 3 bushels per acre. This, added to the actual yields, would credit them with 32 and 28 bushels per acre respectively.

Steinwedel was sown upon the outer edge of the paddock, providing a buffer for the sparrows. The loss from this source proved to be fully from 3 to 4 bushels per acre.

The Bobs in this paddock is not comparable with the others, a portion of it having been grown upon land a part of which differed considerably from the remainder of the paddock; also, at one headland, the soil was out of condition.

The average amount of seed per acre only is given for this paddock, as the areas of each variety cut for hay were not individually calculated. It is the practice to cut a portion around each variety for hay, as it facilitates the subsequent harvesting.

Paddock No. 2: This was sown with three varieties, as a test of their productiveness. It was also used in conjunction with the rotation experiment carried out for wheat. The largest portion had been cropped with cowpeas in 1904, and fed off by sheep. The smaller portion was at the same time bare-fallowed. A portion of the cowpea area, together with the area bare-fallowed, was put under Bobs, the yield being in favour of the bare fallow by practically one bag per acre, or, strictly speaking, 3 bushels 56 lb. This result, in my opinion, was due to the bare-fallow conserving more of the summer moisture previous to sowing, whereas the crop of cowpeas had left the soil drier for the sowing season. Throughout the growth of this area, no difference was discernible, and the shortage of moisture during November and December was no doubt responsible for the decreased yield upon the cowpea area, the reserve of soil moisture not being so great as upon the bare-fallowed portion.

The three varieties grown upon the cowpea area are strictly comparable, and such will prove a guide as to the productiveness of Bobs and Steinwedel when taken in conjunction with the wheats of paddock No. 12, Schneider there being comparable with the other wheats.

In paddock No. 5, Bobs was used in conjunction with rotation and manure experiments. This paddock is decidedly the richest upon the farm, and has topped the average yield per acre of the paddocks.

Paddock No. 4 was devoted to a manure experiment, the manures being applied every year and cropped continuously with wheat. As is usual with

such practice, weeds peculiar to the wheat season were abundant, robbing the soil of moisture, and thus decreasing in some measure the yields. The same variety of wheat was used as at the beginning of the experiment

Paddock No. 6 was devoted to a manure experiment to test the lasting effects of fertilisers several years after their application. This experiment was commenced four years ago, and has been cropped continuously with the same variety of wheat with which it was planted at the beginning. The remarks upon weeds apply similarly to this paddock.

From the fact that these two paddocks had been cropped with wheat each year, instead of being rotated with other crops, precludes any comparison being made with any of the other paddocks.

Paddock No. 20 was sown with Bobs very early to provide feed for sheep if necessary. It had been bare-fallowed previously. It being a poor paddock, it received 1 cwt. per acre of superphosphate with the wheat. It was fed off thoroughly with sheep during June, and again was eaten to the ground during August. Such treatment naturally proved too severe for a large yield of grain, and the yield of 9 bushels 40 lb. must be considered as satisfactory. For these reasons this paddock has not been calculated in arriving at the average wheat yield throughout the farm.

In paddock No. 7 a small area was devoted to a manure experiment and sown with Bobs, to determine the effect of manures the second year after application. It was seriously affected by frost.

The heavy frosts during the winter damaged to some extent several varieties; those most effected being Bobs, John Brown, Steinwedel, and Schneider.

The surprise of the variety tests was the yield of Federation, it topping the yields with 37½ bushels per acre. It is the first year that this wheat has been grown at this farm in a comparatively large area.

Bobs has again held its own throughout the farm, excepting, perhaps, for its predisposition to frosting.

The average yield of No. 12 paddock, viz., 27 bushels 50 lb. per acre was extremely satisfactory, and proves the value of rape in a system of mixed farming where wheat and sheep have prominent places.

The disadvantages of growing wheat upon the same soil year after year are apparent in the yields.

The system of comparatively early sowing has been again demonstrated; the falling off of the rainfall at the close of the year being disastrous to the late sown crops.

All the seeds was treated with formalin of the strength of 1 to 400, the results being extremely satisfactory.

Farmers' Fowls.

[Continued from page 252.]

G. BRADSHAW.

CHAPTER XXXIII.

FAVEROLLES.

THE above is the name given to a now recognised breed of fowls, the district of Faverolles, in France, being responsible for its name, in the same way as the bulk of farm-yard fowls of Sussex in England are named Sussex fowls; and in France the Faverolles answer to what the Surrey or Sussex birds do in London, *i.e.*, make the highest price in the Parisian market, and has been bred by a people whose sole object has been to make profit. The Faverolles is just like the bulk of what our other breeds are, or rather were, a crossbred, produced from two or three other breeds, as were Orpingtons, Wyandottes, Plymouth Rocks, and others, with the object of producing a variety that would fill the bill as winter layers, and make big, early, white-skinned roasters.

M. Rouillier-Arnoult, Director of the French Poultry School at Gambois, says—"To obtain a true explanation of the breed, it is necessary to go back about forty years. The district at that time around Faverolles possessed only a common kind of poultry, together with some Houdans. This was the period when Cochins, Brahmas, and Dorkings first appeared in France, and the poultry-keepers crossed these or some of them with the common fowls, and also the Houdan. The progeny from these crosses had the size and body of the male parent, whilst retaining the delicacy of flesh which has made a favourite of the fowl from the Houdan district."

M. Rouillier-Arnoult then gives a description of the appearance of the birds, and finishes with—"This race is particularly recommended from an industrial point of view. The chickens of Faverolles are exceptionally hardy and easy to rear, a great advantage, which breeders in this country are not slow to appreciate."

This statement as to the origin is not disputed, for in an old English journal in the possession of the writer, printed twenty years ago, a correspondent, inquiring about Faverolles, was told that the fowls known by that name provided the greater portion of the poultry markets in the province of Ile-de-France, and that they were nothing else than the produce of a cross between the French Houdan and the Brahma, and that there was no occasion for him to send to France, as the progeny from the above two breeds would supply his wants. However, since the above date, both Buff Cochin and Dorking blood has been introduced, the former being responsible for the subdued

buff or wheaten colour of the hens, the leg feathers, and the docile disposition of the breed. The Houdan gives them the characteristics of whiskers and beard. The Dorking is most noticeable in the male birds, as seen by the pinkish white legs, five toes, black breast, and distinctly Dorking comb. The Brahma and Cochin are also responsible for the brown eggs, and for the general carriage or type of the bird. Although breeding for feather was not studied by the original producers, yet the different and more or less systematic ways of producing these birds have brought into existence several colours; but so far as the English show-pen is concerned, only the Salmon and Blacks are recognised. In France, the English salmon-coloured variety is called Faverolles saumon. There is also the Faverolles Brahma in France, marked similarly to the breed of the latter name. The Black owes its origin to the Langshan and the Faverolles-Concou.

Mr. T. R. Robinson of the South Eastern Agriculture College, Wye, Kent, lately wrote of this breed—"As to the question 'What are Faverolles?' one might reply, that as the pig in Ireland is said to be 'The jintleman that pays the rint,' so Faverolles are the fowls that bring in the cash to the more advanced commercial keeper of poultry in France. Having had some considerable experience both in England and France on this subject, I will give a few words of description first on the foreign bird, and then as she is made in England may not be out of place here. French Faverolles, as bred by practical men, are by no means true to colour; nor have they any other fixed characteristics. The producer wanted something easy to rear, quick to grow, and with great aptitude to fatten. These ordinary trade factors have existed many years, long before any Fancy element stepped in. It is easy to understand then that with many workers, and many buyers, that there should be great divergence of type, brought on, no doubt, by force of circumstances and greater or less judgment. Surely it speaks well for the people who, without method, with little knowledge of pedigree, and on a very mixed foundation stock of country-bred Houdans, evolved a bird, which on the market superseded all others; hence the variety of type and colour. That Faverolles contain the blood of Houdans, Brahmas, Concou de Malines, and, later still, Langshans, there can be little doubt. A few French breeders have classified them according to colour, yet the greater aim of the growers is not colours, or four-toes, or five-toes, whiskers, or no whiskers, but to breed a bird quick to grow and fatten. From an English point of view it would be absurd to say that they cannot be improved. They may be improved or spoilt. What in my opinion is wanted is quality with early maturity, with as many winter eggs thrown in as possible. Providing these objects are kept in view, there can be no harm in grading them to colour and uniformity of comb, legs (shanks) etc. By doing so they will become a breed that will probably appeal on its merits to a good many poultry raisers. It is not my object to 'write up' or 'write down' any variety of fowls. Personally I am a lover of many breeds, but to those who have the accommodation and ask the oft-repeated question 'What shall I keep?' the reply to some is 'Try Faverolles.'"

The late Mr. Harrison Weir, in his "Book of Poultry," says:—"Faverolles are a table fowl, and should be judged on the poulterer's bench, and there, featherless, all its qualities as a table fowl, rightly, carefully, and most scrupulously considered. The flesh, the texture, the quality, the fat, and the disposition of it, the skin, its thinness, tenderness or toughness, and the colour; and with it all, the fowl should be properly proportioned, not with big thighs and legs, and long shanks, or small thin-made wings, or attenuated breasts, with a deep fleshless keel bone, but all should be kept in unison, square and meaty; keep to this and it matters little what the feathering colours are. This appears to me to be the method adopted by the French, and for utility this is right. Having examined a large number of Faverolles at the Dead Poultry Show, I have come to the conclusion that it would not be so very difficult for the adept in such matters to evolve from the material, as now presented, such a utility breed as described. After careful inspection, I found that some of the very best were four-toed, yet, in some instances, a small toe only just indicating a fifth. This being so, perhaps it would be better to formulate the breed as one with only four toes, though my own experience has taught me that the most cloddy, thick-made, dunghill fowls have been those with five toes. Again, most of the best framed meaty fowls were those with clean shanks, and these very white. This being so, I would suggest that if the Faverolles is to become a farmyard breed, and if carrying the same shapely body, that it would be far more valuable as such with clean, clear, featherless shanks. Beyond this, I see no reason for any alteration in the Faverolles as it stands. It is a breed that should win as a prize bird when fatted and killed and shown as what it really is, and judged as a table fowl by what it is supposed to be."

Mr. Weir's suggestion as to the clean legs and four toes was duly discussed in England a few years ago. Some breeders were agreeable to the proposals, but as the fifth toe and feathered legs were more difficult to secure, the fanciers adopted such, and embodied it in the standard, with the result that, for show purposes, birds minus the fifth or Dorking toe are disqualified from receiving a prize, whilst more or less leg and foot feathers is also a show pen essential.

Mr. J. P. W. Marx, of Basford, Nottingham, an authority on the breed, contributed the following article to the late Mr. Lewis Wright's book:

"Faverolles have for some time been common in the northern part of France, where they were regarded as simply useful fowls. They are the result of crosses to produce good layers, particularly in winter, whose chickens are strong, hardy, and quick-growing, with thin, white skin, and fine bone, abundantly covered with meat, and lending themselves readily, if need be, to artificial fattening. Brahmas or Cochins, Dorkings, and Houdans were used to produce Faverolles, and as the different varieties of those breeds were used indiscriminately, the Faverolles are met with of various colours, yet with well-defined characteristics of habit, shape, and quality. A few seem to have been kept in England about 1892 or 1893, but little was heard

of them till 1896; since then they have become scattered all over the country. Whatever the colour of the Faverolles, the general characteristics are the same. In both sexes the comb is single, upright, medium in size, with neat serrations and free from coarseness. This is a difficult point, since of the breeds which were selected to make up the Faverolles, the Dorking alone has a single comb, which falls over in the hen. The peculiar combs of the Brahma and Houdan are strongly hereditary, and thus all kinds of combs crop up in the Faverolles, and most careful selection is required to get and retain the correct type. The beard and muffling should be very abundant, the beard thick and full rather than long and thin. These, again, being only found in one of the original breeds—the Houdan—are difficult to breed; indeed, the head of the Faverolles is one of its most characteristic and important features. The head itself is broad and short, with small, thin wattles, and stout, short beak. The short, stout neck is thickly covered with rather close-fitting hackles. The body is broad, deep, and wide; the back very broad and flat; the breast is also broad, with the keel-bone deep and prominent; the whole giving a sturdy, massive look to the fowl. Greater length of keel and back is seen in the hen. The wings show boldly in front, yet are distinctly small. The thighs are short and set wide apart, with the knees quite straight. The shanks are of medium length. The legs should be fairly stout in bone without being coarse, and be slightly feathered on the outside down to the end of the outer toe. The leg feather should be soft in texture, with no sign of the vulture-hock too frequently met with. The toes are five in number, and the extra or fifth toe, as in the Dorking, should be clear and distinct. The tail feathers and sickles are full and broad; the sickles incline, however, to be short in length, and are carried rather upright, as in the Brahma; a large tail with long sickles carried low or straight is not in keeping with the build of the bird. The tail of the hen is fan-shaped, and carried rather high. The colour of the Salmon Faverolles cock is quite different from that of the hen. Some are a mixture of black and silvery white, like the Silver Dorking; others, which have the preference, are warmer in colour, like the Dark Dorking. In the exhibitions salmon cock, the beak, legs, and feet are white: any pink colour on the legs should be dealt with severely if it is too prevalent, and should be eradicated. The skin also is white and very fine; a coarse red skin is a distinct fault. The face, lobes, and wattles are red, nearly concealed by the muffling and beard, which is black ticked with white. Neck and saddle-hackles are straw colour, quite free from any stripe, although many cocks still retain the Brahma hackle, and probably will do so for some time yet. The breast is black; very few are sound in breast colour; the majority show white mottling, particularly towards the bottom, others even have feathers tipped with bronze or red. More latitude is allowed with the back and shoulders, which may be a mixture of black, white, and brown. The wing-bow is straw-colour, the wing bar black, and the outside of the secondaries white. The tail, under colour, and thighs are black; the tail coverts may be brown. Some cocks with much less black in them have the breasts

mottled with red and white, and the back and shoulders a rich red brown; these are very handsome, but not in accord with the present standard. The salmon hen is much like a wheaten game. The head and neck are a wheaten brown, broadly striped with a darker brown. Beard and muffling (both are much heavier than in the cock) are a creamy white. Back, shoulders, and wings a wheaten brown, the colour running lighter on the sides until it meets the cream colour of the breast, thighs, and under-colour. Primaries, secondaries, and tail are wheaten brown; these at present are very imperfect, for a great deal of black, or white, or both is to be found in most hens. Face, wattles, legs, and feet are the same as in the cocks. The definition of the colour as "wheaten brown" is not a happy one; it may mean the warm brown of red wheat, or the much lighter shade of white wheat, and the latter seems to be the colour which is required. The fashionable salmon hen is a warm cream colour with a pale brown colour on her neck, back, and tail; a delicate pink or salmon shade in these colours is preferable to a faded, washed-out whitish colour. Any trace of buff, gold, or hard brassy colour should be discarded. There is a very handsome strain of what may be called red wheaten brown hens; the back and sides are blotched with a deep chestnut brown, which runs on to the tail, and the hackles are broadly striped with the same colour; they have a rough hardy look, but are too dark and red for the colouring of the standard.

"The Ermine or White Faverolles are marked like Light Brahmas, and, remembering their origin, it will be found quite as difficult to obtain the clear, densely-striped hackles with pure white body colour, free from ticking. In mating Salmon Faverolles, comb, width of back and between thighs should be attended to in both sexes. The comb should be free from side sprigs, and, if possible of fine quality in the hen, and upright. The best combs procurable should be used, for faults here are sure to appear in the chickens. A cock with heavy beard and muffling is valuable as a breeder. His neck and saddle hackles should be a yellow straw shade in preference to white for cockerel breeding; a slight stripe or ticking of brown or brownish-grey may be tolerated in a pullet breeder. Hens with any black in the hackle, even at the tip, should be cautiously bred from unless it is known their mother was better than they in hackle feather. The feather itself should be rather short, but broad, to give room for the darker centre. The breast of the cock should be solid black from throat to thigh. Many are ticked with white and a few have a mottling of red or brown, and these are likely to breed better coloured chickens than those ticked with white. The sounder the black of the thigh and under-colour the better. Cocks showing much white breed cockerels lighter than themselves and pullets too weak, almost white in under-colour. The tail coverts should be a dark chestnut brown in a pullet-breeding cock and the rest of the tail black. The sheen on the black throughout the cock should be a rich metallic bronze, not a beetle-green shade.

"The hens should be as near the Standard colour as can be obtained. The weak points are wings and tail where black and white are sure

to be found. Hens with much white in wing should be mated with a bird sound in wing, with very little white on the ouside of the secondaries, plenty of bronze on the shoulders, and very little white ticking in his under-colour. The brown colour of the tail may be improved by selecting a cock with abundance of coppery-brown lustre and brown tail coverts. If the tails of his daughters show an improvement he may be mated up next year with the best of them in that respect. The shaft and down of the feather quite to the skin should be a creamy or wheaten brown. Hens with a brown or ashen-grey down throw a number of pullets with black in wing and tail. Faverolles chickens are very hardy and easy to rear, either artificially or naturally, providing that they are given as much liberty as possible, for after the first week they are keen foragers on their own account without being wild and prefer food of their own finding if it can be obtained.

"The framers of the Standard also appear to have drawn it up from a meat-producing point of view; perhaps rightly so, for the breed has found much favour with the fatters, some of whom declare it to be the nearest approach to the old Sussex breed they have met with for some time. The chickens are white when hatched, and their nest feathers are also white; with each subsequent growth more colour appears, but only in the final change do the cockerels acquire a solid black breast, so the weeding out process must not be too hastily conducted. They grow and mature very quickly until the final change into adult plumage, when, like Brahmas and Dorkings, the feathers come rather slowly. The claims of the Faverolles as a table fowl seem to have obscured its excellent laying qualities. Helped by its early maturing quality, however, the Faverolles is also a good winter and spring layer, not easily checked by climatic changes. The eggs vary in colour from white to deep brown—most usually they are a pale brown. Pullets' eggs are deficient in size, but those from mature birds are above the average. The hens are slow to come on broody, though exemplary sitters and mothers, and if checked from broodiness soon recommence laying."

CHAPTER XXXIV.

Faverolles in England.

As stated in the previous chapter by Mr. Marx, little was heard of the breed in England till 1896, but each year since that time they have increased amazingly at the shows, and to further encourage their advancement and popularity a club was formed, whose first duty was to draw up a standard by which the birds were to be judged, and such standard now being embodied in the English Poultry clubs' standard has had the effect of stimulating breeders, by the offering of good prizes at the various English shows, the numbers of the Faverolles at some of the important fixtures now approaching many of the older breeds.

As might be expected, the enterprising Americans did not allow this new breed to escape notice, and, shortly after they became plentiful in their adopted land, several of the American breeders visited

both England and France, bringing from the former country quantities of the recognised show specimens, and from France all the colours of the breed that were to be found in the Faverolles district. Dr. Phelps, a noted ornithologist and poultry breeder, has been the largest American importer, and has spent thousands of dollars on the breed. Other enthusiasts have also spent much money in importations, Mr. J. F. Crangle, a well-known American authority, writing of them in an American paper, says: "The recent importation of Faverolles to this country by Mr. Joseph B. Thomas has brought into prominence this new French breed. The Faverolles have an advantage over others, in being prolific layers of good-sized eggs, which average 24 oz. to the dozen. The colour of the shell would be classed as pale, or very light brown. The fowls are large in size, heavy and plump, with very long full breasts, which carry considerable white meat. There are several types as well as colours. Those selected by Mr. Thomas are known in England as Salmon Faverolles. Having been formed by the union of Houdans, Dorkings, and Asiatics, they combine the good qualities of all these gained under the careful guidance of those who originated them, whose sole object in their production is for gain."

In England, the Faverolles now occupy a prominent position as one of the best utility breeds. All the fanciers journals in that country specially recommend them for both meat and eggs, but particularly the former, this being confirmed by the fact that at all the table poultry competitions it is the one largely shown and favourably commented on by the market poultrymen.

During the past year the *Fish and Poultry Trade Gazette* when writing up the Autumn poultry trade, and the breeds best suited for choice table fowls, said of Faverolles:—"A recent addition to British poultry comes to us from France, and is probably a mixture of the best French breeds and our own Dorking fowl. The cocks are rather similar to the Dorking in colour, but have a muff and beard on the head, feathers down the shanks, and *five* claws on the feet. The female is cream-coloured, except the neck and back, which are red-brown. They are capital table birds and easily fattened, and, as they are hardy and splendid layers in winter, are becoming one of the most popular breeds. They are being largely employed in Ireland by the Chamber of Agriculture for improving table qualities, and before long their distinctive head points will be seen largely in the English markets. In the autumn they should be bought with caution, as they are such an early laying breed and such quick growers that they are developed before most of the other heavy breeds, and become slightly hard. They are at their best about four months old, and even at an early age make splendid spring chickens."

In Ireland the County Council recommended them to the farmers and cottagers, and roadside rearers, on account of their hardiness, equal table qualities to the Dorking and good winter laying, and at several of the distributing stations in that country, where settings of pure bred eggs are sold at nominal costs to all applicants, to improve the poultry stock. A few of the best breeds only are kept. In County Longford there are ten of these stations each having thirty pure-bred

fowls of one or more breeds, and from these stations from January of last year to the end of May, 1,239 settings of hen eggs were sold. At one of these stations—Ballyreaghan, 113 settings ot Faverolles were sold, while at Cornakelly 148 settings of Faverolles were disposed of, a greater number than of any other breed, Orpingtons excepted. Nor do the Irish authorities overlook the good qualities of the Faverolles, for at even the smallest show in that country, classes are provided for them.

Chapter XXXV.

Faverolles as Table Fowls.

Many interesting experiments have been made of the growth of the Faverolles chickens in comparison with other breeds. One was carried out by Monsieur Grange, at the School of Poultry Culture, Gambois France, but as all the records are given in grammes and kilogrammes, the weights although heavy for the age, appeal to few here, and were of small importance beside the series of experiments made in England last year, by Mr. E. Brown, at the Theale College Poultry Farm, Reading. The experiments were the most exhaustive yet made in any country, and although Faverolles occupied a prominent place in all the series of tests, the appended detailed accounts are given here, to show the cost of producing chickens of any breed up to a marketable age and size in England, and although the conditions there in the way of poultry foods are not exactly like those obtaining here, still they afford a fairly accurate guide to Australian breeders, as to the cost of production of table poultry in England, and enable them to form an opinion as to whether, with the distance and other handicaps, we can profitably compete in the world's market with our poultry products.

The experiments commenced in March last year, and concluded on 5th July. The commencement here refers to the time the eggs were placed in the incubator, the hatching being completed on 4th April. There were four lots experimented with, consisting of thirty each of Faverolles, White Wyandottes, Buff Orpingtons, and cross breeds. The mortality was very slight throughout the period of observation, three chickens of the 120 dying during the experiments, and as showing how strictly the tables and figures were kept, the three losses were regarded as part of the cost of rearing.

The chickens were treated throughout in identically the same manner, and were hatched from eggs produced by stock kept on the College Poultry Farm. Each lot were hatched on the same day, in incubators of the same class, when dried off (twenty-four hours after hatching), each lot were accommodated in a brooder of the same class. For two weeks they were kept in heated brooders without grass runs, for two weeks longer in heated brooders with limited grass runs, and for one week longer in the brooders without heat. When five weeks old the cold brooders were removed, and the chickens were placed in a large house without perches, remaining there until the end of the

full period of twelve weeks; these houses were in large grass runs. During the whole time they were fed in identically the same manner, no attempt was made to force growth, and were treated in the natural way. For the first five weeks the brooders were kept in a paddock on the farm, and moved to fresh ground daily. Throughout the entire time careful attention was paid to cleanliness. The houses to which they were removed at the end of five weeks varied somewhat, but each contained about 234 cubic feet of air space. The runs contained about 280 superficial yards each, or about 9 rods, and were laid down in grass. They were well sheltered on the north by large chestnut trees, and were planted with fruit trees, but additional shelter was provided by means of hurdles. At the time the eggs were placed in the incubators, (13th March) their market value was slightly under a shilling a dozen, and in the following calculations they have been estimated at one penny each. The hatching averaged about 70 per cent., thus nearly forty-three eggs were required to produce thirty chickens at the time of hatching, and the egg cost of each chicken was 1·43d. The cost for oil burnt in a 100 or 120 egg incubator is about 3d. per week, and allowing four weeks for regulation and complete hatching, this gives a total of 12d.

Providing for infertiles taken out, and taking two lots in one machine, a total of 6d. per lot is reached, to be divided in accordance with the number reared. One brooder was used for each lot, and the cost of oil consumed in lamps was 1·25d. per week each; that is 5d. for the four weeks. The dry-feeding system had been adopted, and the following report shows the value of that method. The dry food was scattered among the litter, and the birds have to scratch in finding it, thus obtaining constant and beneficial exercise. The following foods were employed during the experiment:—

A.—Dry Food Mixture. (First four weeks.)

	By weight.
Wheat (cracked)	3 parts.
Dari	2 ,,
Canary Seed	2 ,,
Oatmeal	2 ,,
Millet	2 ,,
Broken Maize	1 part.
Hempseed or Buckwheat	1 ,,
Rice	1 ,,
Meat	1 ,,
Grit	1 ,,

One part of 7 lb. will make 1 cwt. Cost, 10s. 8d. per cwt.; 1·14d. per lb.

B.—Dry Food Mixture. (After four weeks).

	By weight.
Wheat (cracked)	3 parts.
Broken Maize	2 ,,
Dari	2 ,,
Buckwheat	2 ,,
Rice	1 part.
Hempseed	1 ,,
Meat	1 ,,
Linseed	1 ,,
Grit and Oyster Shell	1 ,,

Cost, 7s. 6d. per cwt.; 0·8d. per lb.

C.—Soft Food. (After eight weeks)

	By weight.
Barley Meal	4 parts.
Toppings	4 ,,
Meat	1 part.

Cost, 7s. 9d. per cwt. ; 0·83d. per lb.

D.—Biscuit Meal.

Spratt's parent chick meal, 18s. 4d. per cwt. ; 2d. per lb.

E.—Wheat.

7s. per cwt. ; ¾d. (0·75d.) per lb.

The prices charged are those at which the above foods can be purchased generally.

In feeding, the soft food was supplied in sufficient quantities to be cleared up at once. The hard corn was left for about half to three-quarters of an hour, and then removed.

Green food was supplied, but when the birds were out on the grass it was seldom eaten. It was given after hard food, so that the weight of food consumed could be arrived at.

Experiment No. 1.—White Wyandottes.

The average gain in weight in the first four weeks, including the loss of a bird, which died on 15th April, was 5·8 oz.; in the second four weeks, 10 oz.; and in the final five weeks, 15·7 oz.; and that the average cost per bird in the first four weeks was 0·92d.; in the second four weeks, 2·4d.; and in the final five weeks (inclusive of grit for the entire period), 3·5d.

The weight of the thirty birds, when 24 hours old, was 2 lb. 8 oz. At the close of the experiment, the twenty-nine birds, then 13 weeks old, weighed 59 lb. 10 oz.; so that the average gain in weight was 1 lb. 15½ oz. With regard to their respective weights at 13 weeks old, twenty-nine birds averaged 2 lb. 1 oz. The fourteen cockerels averaged 2 lb. 2 oz., and the fifteen pullets averaged 2 lb. The greatest gain was 2 lb. 6 oz., and the least gain 1 lb. 12 oz.

The birds varied in weight on 5th July from 29 oz. to 39 oz., as follows: Five weighed 29 oz. each; one 30 oz.; four 31 oz.; four 32 oz.; four 34 oz.; three 37 oz.; two 38 oz.; and one 39 oz.

While the cockerels made the greatest gain, exceeding the average by 0·74 oz., the pullets were not so far behind as might have been expected, only falling below the average by 0·7 oz.

Experiment No. 2.—Faverolles.

The average gain in the first four weeks was 6·02 oz., in the second four weeks, inclusive of the bird which died on 15th May, 9·8 oz., and in the final five weeks 16·7 oz.; and that the average cost per bird in the first four weeks was 0·95d., in the second four weeks 2·0d., and in the final five weeks (inclusive of grit for the entire period), 3·3d. The weight of the thirty birds, 24 hours old, was 2 lb. 5 oz. At the close of the experiment the remaining twenty-nine birds, 13 weeks old, weighed 61 lb. 11 oz., or an average gain of 2 lb. ¾ oz.

The birds varied in weight on 5th July from 26 oz. to 42 oz., as follows: One weighed 26 oz.; two, 27 oz.; two, 29 oz.; one, 32 oz.; three

33 oz.; seven, 34 oz.; four, 36 oz.; five, 37 oz.; one, 38 oz.; two, 42 oz. each. As to their respective weights at 13 weeks old twenty-nine birds averaged 2 lb. 2 oz. The fifteen cockerels averaged 2 lb. 2 oz., and the fourteen pullets averaged 2 lb. 2 oz. The greatest gain was 2 lb. 9 oz., and the least gain 1 lb. 9 oz.

In this experiment the cockerels did not grow as quickly as the pullets, falling below the average by one-third of an ounce, and the pullets exceeding the average by a little more than one-third of an ounce.

Experiment No. 3.—Buff Orpingtons.

The average gain in weight in first four weeks was 5·6 oz.; in the second four weeks, 10 oz.; and in the final five weeks, inclusive of the bird which died 16th June, 18·0 oz.; and that the average cost per bird in the first four weeks was 1·4d.; in the second four weeks, 2d.; and in the final five weeks (inclusive of grit for the entire period), 3·2d. It will be seen that the greatest growth was in the hot and dry week ending 31st May, and the next greatest in the cooler and moister week ending 21st June, while the least average growth after the first week was in the week ending 17th May, when cooler conditions prevailed. The weight of thirty birds, 24 hours old, was 2 lb. 6 oz. At the close of the experiment twenty-nine birds, 13 weeks old, weighed 63 lb. 2 oz., showing an average gain in weight of 2 lb. 1½ oz. The birds varied in weight on 5th July from 24 oz. to 39 oz., as follows: One weighed 24 oz.; one, 27 oz.; three, 29 oz. each; one, 30 oz.; three, 31 oz.; three, 32 oz.; four, 33 oz.; two, 34 oz.; two, 35 oz.; one, 36 oz.; five, 37 oz.; one, 38 oz.; two, 39 oz. each.

In this case it was found that twenty-nine birds averaged 2 lb. 3 oz. The eighteen cockerels averaged 2 lb. 3 oz., and the eleven pullets averaged 1 lb. 13 oz. The greatest gain was 2 lb. 6 oz., and the least gain 1 lb. 7 oz.

In this experiment the cockerels exceeded the average by ·38 oz., whereas the pullets fell below the average by 3.83 oz.

Experiment No. 4.—Cross-bred Fowls.

This lot of thirty birds consisted of fifteen Houdan-Buff Orpingtons, and fifteen Indian Game-Buff Orpingtons.

The cross breeds did not grow nearly so fast as either of the pure breeds, but there was an equal reduction in quantity and cost of food consumed. The average gain in the first four weeks was 4·3 oz.; in the second four weeks, 10·2 oz.; and in the final five weeks, 13·07 oz.; on the average cost per bird the first four weeks was 8d.; in the second four weeks, 2d.; and in the final five weeks (inclusive of grit for the entire period), 3d. All the birds in this lot were reared, and thus the average gain should have been greater, but several, two especially, made no growth for part of the time, and thus reduced the average considerably.

The weight of thirty birds, 24 hours old, was 2 lb. 5 oz., which was increased at the close of the experiment to 56 lb., showing an average gain of 1 lb. 12¾ oz.

The birds in this experiment varied greatly from 19 oz. to 37 oz., as follows: One weighed 19 oz.; one, 21 oz.; one, 22 oz.; one, 23 oz.; one, 24 oz.; one, 26 oz.; five, 27 oz. each; one, 28 oz.; three, 29 oz. each; five, 32 oz. each; two, 33 oz. each; three, 34 oz. each; two, 36 oz. each; three, 37 oz. each; thus emphasising the importance of selecting the right breed or cross for attainment of early maturity.

The average weight of the thirty cross breeds was 1 lb. 14 oz., thirteen cockerels averaging 1 lb. 15 oz., and seventeen pullets, 1 lb. 13 oz. The fifteen Houdan-Buff Orpingtons averaged 1 lb. 13 oz.; and the fifteen Indian Game-Buff Orpingtons, 1 lb. 15 oz. The greatest gain was 2 lb. 4 oz., and the least gain 1 lb. 2 oz.

This concludes the particulars relating to each of the lots included in the experiment, and it is now possible to make some comparisons of the results obtained by the different breeds.

Comparisons.

The cost of the chickens at thirteen weeks old is arrived at as follows:—

	Lot 1. 29 White Wyandottes.	Lot 2. 29 Faverolles.	Lot 3. 29 Buff Orpingtons.	Lot 4. 30 Cross Breeds.
	d.	d.	d.	d.
Initial cost of egg	1·48	1·48	1·48	1·43
Cost of working incubator ...	0·21	0·21	0 21	0 2
Cost of working brooder	0·17	0·17	0·17	0·16
Cost of food (average)	6·8	6·75	6·5	5·92
Average cost per bird ...	8·66	8·61	8·36	7·71

In 1904 the cost at twelve weeks old of White Wyandottes was 9·1d., and of the cross breeds 9·09d. It will be seen from the above that this year the cost is less, although the birds were fed a week longer, and that the cross breeds are below the pure breeds, but that is partly explainable by the fact that all Lot 4 were reared. In the above no allowance is made for interest on capital, rent, or labour, as these would vary considerably, and can be calculated by poultry-keepers in accordance with their special conditions. The actual cost, inclusive of eggs, working incubator and brooder, and food, works out as follows:—White Wyandottes and Faverolles, a fraction over 8½d.; Buff Orpingtons, 8¼d.; and cross breeds, a little over 7½d.

An interesting point is the comparison of the weights of the birds of each breed at the end of each successive week, as given in the following table. It will be seen that there was very great variation in the growth in different weeks, though, generally speaking, similar fluctuations in growth were made in the same weeks by all the breeds.

Thus the fourth week was a week of considerable growth in each case; again, the eighth week was marked by a great increase in

weight; while comparatively small increases occurred in the first three weeks, and, again, in the fifth, sixth, and seventh weeks.

From the table we find that while, in pure breeds, both Faverolles and Buff Orpingtons started with a smaller weight than the White Wyandottes, after the ninth week they forged ahead, and stood above at the end of the period. Nearly all the time the cross breeds were in the rear, in spite of the fact that not one of these died.

Comparisons of Weights of Breeds.

TOTAL WEIGHTS.

Ages.	White Wyandottes.	Faverolles.	Buff Orpingtons.	Cross Breeds.
	lb. oz.	lb. oz.	lb. oz.	lb. oz.
24 hours old	2 8	2 5	2 6	2 5
8 days old	3 1	3 3	2 11	3 2
15 „	4 4	5 8	4 14	4 8
22 „	6 0	8 4	8 4	6 4
29 „	13 0	14 0	13 0	10 8
36 „	16 0	16 11	15 5	13 13
43 „	19 6	20 2	16 12	17 0
50 „	23 3	23 13	20 2	20 2
57 „	31 2	31 6	31 11	31 8
64 „	37 2	36 6	38 13	35 11
71 „	41 15	43 3	43 15	41 15
78 „	48 14	49 0	52 2	44 5
85 „	51 5	54 7	57 4	49 5
92 „	59 10	61 11	63 2	56 0

In the next table are given the comparisons of the four lots.

General Comparisons.

	White Wyandottes.	Faverolles.	Buff Orpingtons.	Cross Breeds.
Total food consumed	237·55 lb.	233·85 lb.	226·94 lb.	216·34 lb.
Total cost of food	16s. 6d.	16s. 3¾d.	15s. 8½d.	14s. 9¾d.
Weight of food consumed for each pound gained	4·16 lb.	3·9 lb.	3·72 lb.	4·03 lb.
Average cost of food per bird ...	6·8d.	6·75d.	6·5d.	5·92d.
Cost of increased weight per pound	3·45d.	3·3d.	3·1d.	3·3d.
	lb. oz.	lb. oz.	lb. oz.	lb. oz.
Average gain in weight	1 15½	2 0¾	2 0½	1 12⅜
Average weight (thirteen weeks)..	2 1	2 2	2 3	1 14
Average weight (cockerels) ...	2 1½	2 2	2 3	1 13½
Average weight (pullets)	......	2 2	1 13	1 12½
Greatest gain	2 5½	2 8¾	2 5¾	2 3¾
Least gain	1 11½	1 8¼	1 6¼	1 1¾

As the greater part of the chickens raised were required for breeding stock or for later fattening, they were not killed on 5th July, and thus the gross profit cannot be stated. The experiment, however, shows

the actual cost of hatching and rearing to thirteen weeks of 117 birds, as follows:—

		£	s.	d.
29	White Wyandottes, at 8·66d.	1	0	11
29	Faverolles, at 8·61d.	1	0	$9\frac{3}{4}$
29	Buff Orpingtons, at 8·36d.	1	0	$2\frac{1}{2}$
30	Cross Breeds, at 7·71d.	0	19	$2\frac{1}{2}$
117	Total cost	£4	1	$1\frac{3}{4}$

The total weight of chickens produced at thirteen weeks was 241 lb. 2 oz.

[This subject will be further dealt with in next issue.]

Chapter XXXVI.

MADE IN AUSTRALIA.

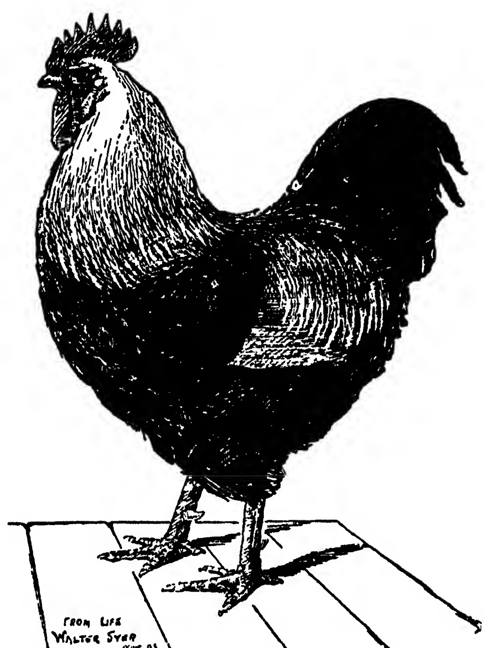
As has been shown in previous chapters, a few breeds of fowls, notably Game and Dorkings, have been known in England for generations, their origin and ancestry being difficult to determine, nor does it matter now how they originated. Numerous other breeds and varieties, plentiful and popular, have appeared within the past twenty or thirty years, America and England being responsible for their advent.

These now acknowledged breeds were all the results of crossing from and with the older ones. For a few years they were comparatively nondescript in appearance. However, the patience and perseverance of fanciers brought them to such a state of perfection in colour and type, that they now breed as true as do those whose origin is lost in antiquity.

So far as Australia is concerned, the same material was available as in the Old Country for making breeds, but few troubled with the matter, as years of patient experimenting are required for the completion of such a task, with the result as new breeds appeared in other countries, and became established there, Australians, rather than manufacture, adopted the system of purchasing, and perhaps improving, the ready-mades of other countries.

That this method has been a satisfactory one is evidenced in the show-pens of to-day, the mammoth Orpingtons, artistically coloured, and mathematically-marked Wyandottes, with all their commercial merits, leaving but little more to be desired by the most exacting fancier, farmer, or other breeder. Still the same thing could have been as safely said before the manufacture of the above two breeds. The Langshan was a meat and egg fowl, while others possessed favourable commercial essentials, all of which points to the conclusion that the poultryman's desire for something new is never satisfied; and should present or future experiments demonstrate that the possibilities of crossing are not yet exhausted, and something newer, if not better than we have, be produced, there is not a doubt that breeders will give it the usual hearty welcome, and if such an origination takes place in Australia, and such be duly and prominently brought before the public, patriotism alone should be a guarantee of a successful future for the Australian fowl.

When writing on this subject in 1897, I then showed that Australian Game were the outcome of crossing the Old English Game and Malays, the object being, not to get an exhibition bird, but, rather, one superior in fighting qualities, hence what is known as Australian Game were more of an evolution than a manufacture. However, something more definite in the matter of fowls made in Australia was mentioned in the same *Gazette* as above. This was a blue fowl, originated in a Melbourne suburb by Mr. J. C. Coupe. They partook a good deal of the Langshan type, and were named Royal Blues. A few came to Sydney, and classes were made for them at one or two shows, but all inquiries on the subject now elicit that the breed, if it ever was one, is now extinct.



Imperials.

A few years ago it became generally talked about in Sydney poultry circles that Mr. W. E. Boutcher, of Canterbury, had originated a breed to which he gave the above name. Classes were made for them at some of the Sydney shows, the originator, who made a good display of the breed, being the only exhibitor. Some time after they appeared in the Hawkesbury College laying competition, and though the result from one pen does not determine much, still, as this new breed had but a year or two's existence, and in the hands of few people there could be but one strain, the termination of the

competition showed that the Imperials behaved splendidly, the six hens producing 146 eggs each, followed by Orpingtons with 137, and Leghorns 136.

Following this came the third yearly competition, wherein 100 pens competed, and here again the Imperials distinguished themselves, the six hens laying 949 eggs, or 158 for each hen, this time being one egg behind the Orpington averages, and ahead of Wyandottes and others. The pen finished in the forty-first place, thus making a better performance than fifty-nine of the competing lots. The eggs were also of good size, weighing 25½ oz. to the dozen. It is, however, at the present 1905-6 laying competition wherein the Imperials have not only justified the existence of an Australian-made article, but also their name as well. The competition commenced on the 1st of April last year, 100 pens of six birds each again competing, and at the close of the eleventh month, one pen of the Imperials have laid the grand total of 1,188 eggs, or 198 for each hen, and are within one egg of second place in the 100 lots. Another pen of Imperials also competed, and again the records are exceedingly high, the total for the eleven months being 1,089, or 180 eggs for each hen. The above are the public tests wherein the birds have appeared, and it is safe to say that no other breed or variety has performed so consistently.

Mr. Boutcher contributes the following on his origination:—

"In dealing with the above breed of poultry, I may say its introduction was not to supply a long-felt want in the shape of a general utility fowl, but rather to show what can be done by crossing judiciously. The Imperial is certainly a farmer's bird, being built to suit the farmer's purpose as an egg-producer and good table variety. The breeds used in its construction are all well-known kinds, viz., Golden Wyandotte, Brown Leghorn, Partridge Cochin, and Black Orpington. With the exception of the Partridge Cochin, the remaining parts of its composition are all looked upon as good layers, the last-mentioned being used only to secure the desired colour, which turned out very well. As a layer, the Imperial can stand side by side with the most popular egg-machines we possess, the laying competitions having verified that, whilst the table qualities of the breed rival our best.

"The Imperial was brought before the public in 1901; classes were provided for them at the New South Wales P. P. C. and D. Society in 1902, which was copied by most of the leading poultry shows. So far the Imperial has not received the patronage it deserves from the general public.

"In commenting on the new breed, the *Sydney Morning Herald* of 6th June, 1903, says:—'The cock is a handsome and symmetrical bird, weighing about 10 lb. Its rich plumage recalls the bright colouring of the Partridge Cochin, but its dark legs and feet are free from feathers. Its headpiece and general shape suggest the Orpington. The ground colour of the hen is dark, with buff pencilling, the average weight being 7 lb. Classes for Imperials were provided at recent shows. As a table bird the weight of the Imperials speaks for itself. As a prolific egg-producer no better evidence of the value of

the breed can be given than the result of the laying competition recently concluded at the Hawkesbury College. This event was a twelve months' test, open to all. Thirty-eight pens, each containing six hens, represented various breeds. When the averages were extended at the termination of the competition, it was found that six Imperials had averaged 146 eggs each. Seventy-six Orpingtons were second with 137 each, and forty-two Leghorns third with 136.'

"In dealing with the same subject, the *Daily Telegraph* of April, 1902, says:—'What may be termed the first successful effort in Australia to originate a breed is that of Mr. W. E. Boutcher, of Canterbury. The breed, to which he has given the name of Imperial, seems destined to yet make a name. Briefly, it is a partridge fowl of the Orpington type, and as a general utility bird it ranks with Mr. Cook's creation.'"

As a general utility fowl suited for farmers or other breeders whose object is profit, the Imperials should fill every requirement. The Leghorn, Wyandotte, and Orpington are a combination of utility, the Cochin blood being responsible for the colour.

The breed has now made a name for itself at the three competitions, the most notable thing being that while many good performers in the early tests have done badly in later competitions, the Imperials have done better each time they tried, all of which goes to show that fowls can be not only made in Australia, but superior ones at that, and when those about to begin poultry-keeping, or others desirous of changing bad performers to good ones, the pocket will be consulted and patriotism gratified by adopting the Australian-made, aptly named Imperials.

(*To be continued.*)

Codling Moth Parasites.

WALTER W. FROGGATT, F.L.S.,
Government Entomologist.

The exact meaning of the term "parasite," when applied to a useful insect that in any way destroys injurious species, needs to be strictly defined, for there are many that, though they may now and then devour or infest a destructive grub, are only casual enemies, and have no appreciable effect in checking its increase or ravages. Others, often called parasites, are simply lodgers (*inquilines*), that take shelter in the same cavity or gall, and though from their presence may often crush the rightful occupant to death, are not active enemies.

When we talk about the parasite of any particular insect, we infer that it is a carnivorous insect, which, in the larval or perfect stage of growth, destroys an injurious species, which it seeks for as its natural food, or else some native or introduced creature that has developed a preference for the pest insect, and hunts for it on its own account.

Now, the codling moth is probably one of the oldest orchard pests in the world, for the quince and apple were among the first fruits cultivated in Europe, as the Roman writers mention wormy apples. Therefore, it is certain that any parasite that attacked it in its native home is also one of long standing; and while the trees were small, smooth-stemmed, and looked after, the shelter the codling moth grubs could find was slight, and their loose silken cocoon was easily torn off by birds, or pierced by the ovipositor of internal parasites, or the jaws of external ones.

The codling moth was always a pest; but while small areas only were planted with apples in the old world, every apple that fell was picked up and used for something, and particularly in the larger English orchards, where the bulk of the apples were turned into cider, everything was crushed up, codling moth grubs, and all wormy fruit; there was no waste! When, however, the cultivation of the apple in America and Australia increased a thousandfold, and large paddocks were planted with fruit-trees, the whole system of cultivation was altered, and waste fruit was not worth gathering up, when there were thousands of cases of better fruit hanging on the trees, all ready to be packed. Neither the trees nor the crops received the attention they could in small areas, and many farmers, who were not actually orchardists, planted some trees in a more or less haphazard fashion, and, after a while, neglected them for more profitable farm work.

If all the orchards were in the hands of people that made orcharding their sole business, they would be more or less looked after; but where the owner has many other things to attend to, the orchard, particularly if the farmer

does not understand the work, becomes one of the least profitable, and, in consequence, the most neglected. This State is full of the remains of hundreds of what were once very fine orchards, where thousands of pounds have been expended in the owner's lifetime, and which the next generation have neglected, until now they are simply used as calf paddocks, or handy places to turn out a horse. As the law stands at present in New South Wales, however willing the working orchardist, who has to depend on his fruit crop for his living, is to agree to some form of legislation to deal with such universal pests as codling moth and fruit fly, we find a very large antagonistic section who have virtually no interest at stake, except that they would have to destroy their worthless orchards, and put the land to some use. The prolific manner in which all kinds of fruit-trees grow in the suburban gardens induce every householder to plant a few trees, which, while they are producing good crops, are looked after to the best of his knowledge, but as soon as they begin to fall off in production, are neglected in consequence. These are another source of danger to the professional orchardist, for the suburban gardens spread out all round the outskirts, until they touch the more well-defined actual orchards of Ryde, East Hills, and Parramatta.

If fruit-growing for export is going to hold its own, and extend into other markets, it will be necessary to adopt some of the methods of the adjoining States, where legislation is enforced, and where selfish or careless people cannot injure the industry of their neighbours. New South Wales has many natural advantages, both in climate for growing all kinds of fruit, and such a port as Port Jackson for shipping it all over the world. The coastal districts from Sydney up northwards can grow some of the finest oranges in the world, and there is enough good land suitable for citrus fruits in the counties of Cumberland, Camden, and Northumberland to supply all the markets of the Southern hemisphere with oranges and lemons. We have the cool tablelands of Bathurst and Orange on the one side, and New England on the north, exactly suited for apples, cherries, and cold climate fruits, while on the far away Northern rivers we have a sub-tropical climate, yet, with all these advantages, we cannot supply our own local consumption, and our imports of fruit largely outweigh our exports.

The information furnished by our fruit inspectors in the Annual Report, 1904-1905, shows that during that year, 926,622 cases of fruit were imported from abroad, through the port of Sydney alone, an increase of 147,145 cases over the previous year; besides these we received 852,021 bunches of bananas, an increase of 101,417 bunches in the twelve months. In the vegetable world we received 645,507 bags of vegetables.

In healthy competition with the world's markets there are always times of scarcity, when fruit and vegetables will sell with ours, but the excess of imports is very much beyond that limit, considering that we grow many fruits all the year round. While this stream of fruit is pouring into New South Wales, we find the orchardists loud in complaints that they are losing money all the time, and that it won't pay to grow fruit in this State. If this is the case, and if it is not the fault of the orchardists themselves, we must

look beyond, and try to find the reason. The ordinary orchardist will tell you that legislation dealing with the regulation and control of orchards by boards, consisting of their own men, or directly worked by the Department of Agriculture, will ruin the industry. Even the more progressive growers that have proposed " mild legislation," are emphatic that only two pests should be placed on the statutes, namely, fruit-fly and codling moth, quite ignoring the fact that cherry-slug, pear mite, aphis, and scale are just as easily spread from dirty orchards. Nevertheless, it is the countries that have Vegetation Diseases Acts in force that have built up their fruit industry and export trade that compete so keenly with the growers of New South Wales. It is not claimed that legislation will stamp out any pest, but it will give the earnest capable grower some chance to deal with his own codling moth and fruit-fly without having to face those grown by his neighbours. I have been called to task by some of the Cumberland growers for saying that no sensible man would go and invest his savings in an apple orchard in New South Wales, however good the land and climate, under the present conditions of the Vegetation Diseases Act; but the more I see the stronger my convictions are on this point. Right in the heart of the best apple and cherry orchards in Australia, near Orange, surrounded with large orchards well looked after and up to date, there is a small neglected orchard which has fallen into the hands of an absentee owner, that is capable of breeding out enough codling moth, cherry-slug, and other pests to re-infect all the surrounding orchards year after year, while the men on the other side of the fence can do nothing to compel the owners to clean or destroy his useless fruit trees.

While we have some native pests, like other countries, that do a considerable amount of damage to cultivators, many of our worst enemies—insects and weeds—have been introduced from elsewhere. Scale insects (*Coccidæ*) have been always looked upon as the orchardists' worst pests, and still do a great deal of damage; but since systematic spraying and fumigation have been introduced into the orchard and garden, they have in the hands of capable men done much to mitigate this special group, and are more or less under control in our well-cultivated orchards.

At the present time every orchardist will tell you that the fruit-flies and codling moth are the two most formidable enemies of cultivated fruit, and from their habits the most difficult to deal with in an orchard. So acute has become the feeling among the more progressive orchardists of this State, that they have been agitating for special legislation to deal with these pests; and such an Act would have probably been passed before this if it had not been for the people, who object to all forms of legislation, raising the cry, "Why not import parasites to kill off these pests as they are doing in Western Australia and California?" Such a plausible theory as parasites always appeals to the average man and the Press took the matter up, so that the hands of the "no legislation orchardists" were strengthened until at length the proposed legislation was dropped. Now, even if the Department of Agriculture in New South Wales went out on the "parasite" plan, the first

thing required would be some form of legislation to deal with the orchards within the State. The two States that have taken up the "parasite theory" have enacted the most drastic Vegetation Diseases Acts with powers far beyond anything ever proposed by the officers of our Department. While the trained scientific entomologist is well aware of the important part that the carnivorous insects play in the control of the plant-devouring ones under natural and even artificial conditions, he can foresee their limitations, and knows that they will only keep the balance of power and destroy the superfluous life that is always more or less in evidence, but has so many different climatic and other conditions to contend with that the carnivorous parasite is only one of the many.

We can, however, unhesitatingly state, in spite of all that has been said and written to the contrary, that no effective parasite has been introduced from abroad either into California or Western Australia that has made the least impression upon the codling moth or the fruit flies that lay their eggs beneath the skin of the fruit. At the same time, there are quite a number of parasites known to infest these pests in all stages of their development, or devour them in the ordinary way when they come across them while hunting for food; some of these have evidently been imported to Australia with the pest, while others—native to the soil—have acquired the habit; but in most cases they devour or infest the pests in common with other suitable food.

In this paper, I propose to note some of the more important useful insects that have been recorded as enemies of the codling moth.

Codling Moth Egg-parasite (Trichogramma pretiosa).

This tiny little parasitic wasp was described by Professor Riley in his "Fourth Report of the Entomological Commission of the U.S. Department of Agriculture." Slingerland (*Bulletin* 142, *Cornell University Agr. Exp. Station*, 1898) reproduces his figure, and gives an interesting account of breeding them out of the eggs of codling moth at Ithica. The eggs of the moth are not as large as the head of an ordinary pin, yet as many as four little wasps were bred from a single egg.

This parasite is also said to have been found in California as far back as 1889. In the "Annual Report of the New Zealand Department of Agriculture for 1901," W. A. Boucher recorded the discovery of a parasite in the eggs of codling moth at Waikumete, which was said to have greatly reduced the number of grubs in that district. A considerable amount of interest was taken in this parasite in Australia, and great things were prophesied at the time, and specimens sent to Dr. Howard, at Washington, were identified as this American parasite. It was carefully watched during the following year, and the following memorandum (*Annual Report, Department of Agriculture*, 1902), furnished by Mr. Boucher, is interesting reading:—"Investigations this season of the effect of this parasite, tend to show that, as far as early and mid-season fruit is concerned, little or no appreciable benefit in a substantial reduction of the proportion of moth-infected fruit is derived. A brief consideration of that period of the life history of the parasite which bears upon this point will explain the reason for this. As the parasite

remains dormant in the egg of the codling moth during the winter and spring months, it is evident that the number of parasites that will again be present at the commencement of each fruit season to continue the destruction of the codling moth eggs, will depend upon the number of parasitised eggs that remain uninjured during the winter, the proportion of which, under ordinary circumstances, and without artificial assistance, will be very small,—so that the parasite commences every season heavily handicapped for its good work by its sadly diminished numbers. Although multiplying again rapidly, the season is well advanced before it becomes sufficiently numerous to destroy the eggs of the codling moth in such numbers as to perceptibly reduce the percentage of infected fruit. Thus, while the percentage of moth-infected fruit of early and mid-season varieties remains much the same, a percentage of the fruit of the later varieties will apparently be saved from the moth."

It is, therefore, apparent from these observations, and the fact that this little wasp has been recorded since 1889, that very little can be expected from it as an effective parasite. In 1889, Popenoe discovered in Kansas a curious hymenopterous parasite (*Goniozus sp.*), feeding externally upon the back of the codling moth grub. These tiny little black wasps lay a cluster of eggs in or upon the grub, the resulting wasp larvæ living on the outer surface of the grub, with their heads buried in the body, and when full-grown spinning a bunch of little loose brown cocoons on the shrivelled remains.

Codling Moth Parasite. (Goniozus antipodum.)

This little proctotrupid wasp was described by Professor Westwood in 1874, when he figured it in his work "Thesaurus entomologicus Oxoniensis" dealing with a number of specimens in the Hope Collections; these specimens came from Adelaide, South Australia.

I am indebted to Mr. Tepper for the specimens now re-discovered, as a parasite on the codling moth. Towards the end of 1904 he received a letter from Mr. Woolcock, of Lyndoch, who said:—"Accompanying this note is a parcel containing some specimens of codling moth larvæ, with something attached to the grubs like eggs; and I thought in the interests of science, it was my duty to forward them to you for identification, as they look to me like parasites. I have all my apple and pear trees bandaged as trapping for the codling moth grubs, and to-day, when examining the bandages, I got a lot of the larvæ, including those sent to you. They were quite dead when I found them. I shall be glad if you can give me any information about them." Mr. Tepper says in his letter from which I take this extract:—"I found one larvæ still quite fresh and uninjured, and with two of the 'eggs' oval yellow bodies, but too large in proportion to the host to be such, still attached thereto; while there were several active minute, legless, spindle-shaped grublets on and near the two codling moth grubs, into which the remaining 'eggs' were likewise subsequently transformed. The latter, therefore, seem to represent the resting forms of the former. The grublets were of the same colour as the host, but with black mouth parts. This being the first time a real parasite of the codling moth has come under my notice, though I have been familar with the

pest for nearly twenty years, I was anxious not to disturb the development of the insects more than could be helped, and, therefore, restored the covering and put the box away for the holidays. After these a brief examination showed that some small white silky cocoons had been formed between the papers around the host. On 10th January (they were received on 21st December), a live image was first noted, but circumstances prevented further examination until the 16th, when three dead wasps, one male and two females, were found besides several dead larvæ, while the remains of the codling moths were partly eaten away and dried up." He further says: "As this indicate that the hatching season of this parasite is the first fortnight in January in the Adelaide district, this is the time for observing its habits."

The perfect wasp is of a uniform shining black colour, with dull yellowish antennæ, and reddish brown legs, with somewhat swollen thighs on the fore legs, the wings semi-opaque, with the nervures black. The head is very large and broad, with short curled antennæ composed of thirteen segments, large eyes, with three small ocelli situated on the hind portion of the summit of the head. The front of the thorax is narrow, with the apical portion slender where it joins the slender ant-shaped body, tapering to a slender point in the female, furnished with a very fine sting-like ovipositor. It measures 2½ lines in length, with a wider expanse across the wings.

The genus to which these curious little ant-like wasps belong has a wide range. Nineteen species are described, nine of which come from America, three from St. Vincent, five from Europe, one from Batavia, and one from Australia. Early in January, 1903, Mr. W. A. Grassick, of Orange, discovered an ant-like wasp under the bandages of his apple-trees, and sent me several specimens, with the information that he found the perfect insects devouring the codling moth grubs, and in one part of his orchard they were quite numerous. These specimens were put away with other material. When working up the parasites of codling moths, I found, on comparing them with the South Australian specimens, that they were identical. So we find that this true Australian parasite, known over thirty years ago, has a wide range from South Australia to New South Wales.

Codling Moth Parasite (Perisemus *sp.*)

In the early part of last year, paragraphs appearing in the Victorian newspapers reported the discovery of a new parasite of the codling moth at Newstead. Through the kindness of Mr. C. French, Government Entomologist, Victoria, I obtained two specimens of these little wasps, also, like the previous species, belonging to the family *Proctotrupidæ*, in which, unlike the more numerous *Chalcidæ*, the members have the antennæ not elbowed, and are large headed and of a general ant-like form, and in some cases the females are wingless.

This is also parasitic upon the grub and pupa of the codling moth, and is closely allied to the genus *Goniozus*, but as the antennæ on both specimens

are damaged, it is difficult to place it in its exact genus; but, judging from the general structure, I propose to place it in the allied genus, *Perisemus.* This group contains twelve species, ranging from Ceylon to Europe and America. They are all small shining black ant-like creatures, with the head somewhat narrower than the former group, the antennæ composed of thirteen joints, the legs short, stout, and the femora much swollen. Ashmead says: "This genus could only be confused with *Goniozus*, with which it agrees, except in having twelve-jointed antennæ, and having a slightly narrower head."

Mr. French's specimens are of the usual uniform shining-black tints, with only the tibiæ and tarsi of the legs dull yellow to reddish brown. Each measures about 1½ lines in length.

The Kenthurst Parasite (Pteromalus, *sp.*).

I have received several hymenopterous parasites from Mr. Luke Gallard, of Kenthurst, which he informs me were bred out of the cocoons of codling moth.

This insect belongs to the family *Chalcididæ*, most of which are parasitic in the larval and pupal stages of their existence. The genus *Pteromalus* contains nearly 1,000 described species from all parts of the world, immense numbers of which were created by Walker in the British Museum. Eight species are described from Tasmania and Australia, and the world wide parasite of the cabbage butterfly *Pteromalus puparum* is common about Sydney, and can be bred in hundreds from the pupa of the orange butterfly (*Papilio erectheus*). Here we have a group of minute parasitic wasps that should have certainly done something towards checking the increase of the codling moth, as they can run about among the foliage, creep under the bandages, and into cracks and crevices in the bark, yet the orange butterfly parasite has never been bred out of codling moth pupæ, and this species is rare, and Gallard has only bred a few specimens.

This species is of the typical stout form, of a uniform black colour, thickly punctured on the head and thorax, with the ovote-pointed abdomen smooth and shining. The antennæ are strongly elbowed at the large basal joint, and the head is broad across but short in length, with three small ocelli forming a triangle behind. The legs are thickened slightly on the thighs, and both they and the antennæ are thickly mottled with yellow, only the two terminal joints of the latter being black.

The Spanish Parasite (Ephialtes carbonarius).

This is the Ichneumon wasp that Compere claims to have found in Spain to be an effective check upon the codling moth, and later on introduced into California to control the pest in America. It belongs to the large parasitic wasps, most of which lay their egg or eggs in or upon the bodies of the living caterpillars of moths and butterflies; in no instance do they kill

the grub in the process, but the baby ichneumon hatches out of the egg and feeds upon the soft tissue of the host, never injuring the vital parts of the caterpillar, in the early stages, which feeds and grows in the usual manner, and very often spins its cocoon and pupates before the enclosed parasite is fully developed, and ready in turn to pupate in the shell of what was once a live caterpillar or pupa. When fully developed the parasitic wasp, generally in the following season, gnaws its way out through the side of the pupa or cocoon, which it easily manages with its stout jaws, and the work of reproduction and infestation goes on again. In no case does the fierce ichneumon "stab its victim to death with its ovipositor, and at the same time deposits its eggs in the body of the caterpillar," as is frequently stated in newspaper reports; if this were the case, the baby ichneumon would die in a very short time among the rotten remains of its host.

Ephialtes carbonarius belongs to a large genus of the *Ichneumonidæ*, containing about eighty described species, world-wide in their range. One species, *Ephialtes annulatus*, is described from Tasmania by Brullé, in his "Natural History, Insects Hymenoptera, 1846." *Ephialtes carbonarius*, from which so much is expected, was described by the entomologist Zschuch as far back as 1788, over a hundred years ago, and has a wide range over Europe. Another, the most common species widely distributed over Europe, is *Ephialtes manifestator*, which is frequently met with in the pine forests of Germany, where it attacks the larvæ of wood-boring beetles. Eighteen species among those described are American, so that the species are well distributed. In Australia there are a great number of large and handsome ichneumons that destroy caterpillars in the usual manner, but few, if any, have been bred from codling moth grubs; even in America only two of the true ichneumons have been recorded as attacking the codling moth, and then only in a casual manner. Of course, if you enclose a number of any of these wasps in a large breeding cage with exposed codling moth grubs, they will, in the course of nature, deposit their eggs in the only available food supply at hand; but turn the parasites out into the open (unless you are going to net your apple-tree over to confine the ichneumons to this special diet), and they will soon turn their attention to any kind of *lepidopterous* larvæ that they come across. Everything in a casual way eats codling moth grubs when they are exposed. Hardly a single one escapes the many carnivorous insects, such as soldier beetles, ladybird beetles, their active little larvæ, and a score of other active enemies; but if the ichneumons parasitised these apple-grubs, both grub and parasite are destroyed.

Many birds eat codling moth grubs, and it is quite a common thing to find bandages pulled off the apple-trees, where our magpies are plentiful, for they soon find out that the grubs are to be obtained under their shelter. The first instinct of the codling moth grub, on leaving the shelter of the apple in which it has been feeding, is to seek a secure place to winter in, and where the orchard is old, and the limbs and branches of the trees full of cavities, they soon find such shelter.

The fewer the places of shelter the better; the removal of all infested apples before they fall from the trees, as well as all windfalls, will soon bring down the average of infested fruits. Parasites may do something, and we know they are always at work, but they would not clear an orchard without some assistance from the owner.

So much has been claimed for the parasite in California, that people have become quite impressed with the idea that Australia is quite behind the times in all progressive entomology or original work, so that I think it would well repay the Governments of the Eastern States (Tasmania, Victoria, South Australia, Queensland, and New South Wales) to send a qualified entomologist over to California, to study and report upon the methods in vogue in the United States, and the exact position that the parasite occupies in the mind of the actual fruit-grower, who has been receiving experimental packages of useful insects from the Horticultural Commissioners for the last sixteen years.

In New South Wales, the Department of Agriculture, through the officers in charge of its different branches, is quite ready to learn anything that will help to build up the staple industries of the State.

TILLAGE.

R. W. PEACOCK.

Ploughing.

Ploughing is one of the most important operations pertaining to the cultivation of the soil. It is an operation requiring judgment on the part of the farmer. The depth to plough for certain crops is a much debated point. We find some farmers advocating shallow and others deep ploughing. There are some who claim that crops may be grown without ploughing at all. That satisfactory results from unploughed land may under certain circumstances be obtained speaks volumes for the nature of the soil and conditions obtaining upon the farm, rather than for the ability and foresight of the farmer.

Reasons for ploughing.

The land is ploughed to prepare it for the reception of crops. The stirring and pulverising of the soil renders it more fertile. By allowing the air to circulate freely, the chemical and bacterial actions essential to the rendering available of plant-foods are increased. By pulverising and fining of the soil particles, the internal surface of a soil is considerably increased, thus extending the feeding area for the roots of plants; such also increases the capacity

of a soil to retain moisture. Ploughed soils have a greater absorptive power of plant-food and moisture from the atmosphere. Fresh surfaces are continually being exposed to the beneficial effects of the weather, &c. By deep ploughing these agencies are carried deeper into the subsoil, thus increasing the depth of soil.

The depth to plough.

The nature of the soil, the amount of vegetable matter at the surface, and the crop to be grown regulate the depth which it is advisable to plough. It is extremely desirable that the surface of the soil should be of a suitable texture to allow the air to penetrate freely; this is best preserved by the presence of vegetable matter at the surface. Upon thin soils with a limited amount of vegetable matter it is not desirable to plough deeply, as the subsoil, which contains little vegetable matter, is brought to the surface, where the particles are apt to run together after rain, thus destroying the desirable mechanical condition. If such soils are required for deep-rooting plants, and the subsoil is retentive, they should be subsoiled, the subsoil being stirred without bringing it to the surface. By the action of roots and the free admission of air the soil is deepened. Vegetable matter gives to the soil a richer darker colour; the junction of the darker mould and the subsoil is very clearly defined in some thin soils. If thin soils are ploughed deeper than the depth of mould, they should be left to aerate and sweeten several months, preferably during the winter, before the seed is sown. There are some soils, such as sandy loams, which are easily penetrable by air, and are sweeter and may be at first ploughed deeper than others. Heavy soils are not so permeable and require more frequent ploughings than the lighter ones to get them into condition. As a general rule, it is advisable, when land is ploughed deeply, to allow it to weather for several months before sowing a crop. Deep ploughing may be classed as anything over 6 inches, and shallow ploughing under 6 inches. Excepting under exceptional conditions it is not wise to plough ordinarily deeper than 8 or 9 inches; if the subsoil wants stirring beyond this, for deeper-rooting plants, it should be subsoiled. For cereal crops, such as wheat, the deeply ploughed land should be sown early to allow of root development before the winter rains. Some plants require their food near the surface. Wheats and ryes root deeper than barleys and oats: land for the former may be ploughed deeper than for the latter cereals. When it is desirable to plough lands deeper than formerly, it is wise to turn up only small portions of the subsoil every ploughing, rather than to plough from 5 to 8 inches in one ploughing, unless a considerable time is given for the inverted soil to sweeten.

Ploughing is also necessary for the covering of crop-residues and weeds. For this purpose the furrow-slice should be broad and almost completely inverted. For fallowing, the furrow-slice should be narrower and stand more upon its edge, thus giving the greatest possible surface to the weathering agencies. The above is best performed by mould-board ploughs, the disc implements not covering weeds and crop-residues satisfactorily; also, after

the disc, the surface is left too flat for purposes of fallow. For the covering of weeds and their seeds, and the thorough working of the soil, no implement can take the place of the plough.

Rolling.

This operation in farming is not thoroughly understood by the majority of farmers, and frequently considerable damage is done to crops by rolling indiscriminately. Cereal crops are often rolled and left in that condition, whereas it would have been preferable to have only harrowed them.

Rolling is decidedly advantageous when carried out with judgment. In many cases, as ordinarily practised, the effects are undoubtedly harmful.

The roller can be used to advantage in compacting and solidifying loose open soils. Grass lands freshly broken up should be compacted with a heavy roller before being sown with a crop. The roller helps considerably in the preparation of the seed-bed by crushing clods and smoothing the surface. By compacting the surface-layer the capillary connection between the subsoil and the atmosphere is re-established, thus bringing the subsoil moisture to the surface. This fact is made use of in the germination of small seeds which can only be covered from ½ inch to 1 inch deep. Such seeds germinate more readily on account of the surface moisture being fed from the subsoil. The sun and wind act upon this moisture at the surface, and a considerable loss may ensue, a loss which, under ordinary conditions, cannot be afforded. To prevent this the harrows should be used whenever practicable after the roller to establish a loose soil-mulch, which prevents for a time the evaporation of soil moisture from the surface. Upon cereal crops the roller is used by most farmers solely to smooth the surface and facilitate the use of harvesting machinery. It will be seen from the above that considerable moisture may be lost from the compacted surface. Upon light open soils the harrows should follow the roller. After a wet winter or a season of sufficient rainfall to consolidate the ordinary soils the roller is superfluous, and the harrow would be preferable for breaking the clods, at the same time leaving a valuable soil-mulch. The rolled surface upon some soils easily runs together and crusts after rain, thus excluding air and getting out of condition generally. The roller is an excellent farm implement when used with judgment; without judgment, upon many of the wheat-farms it would be preferable to discard the roller and substitute the harrows.

The Jerusalem Artichoke

(*Helianthus tuberosus*).

THIS hardy but little-cultivated tuberous perennial is a species of sunflower. The word Jerusalem is a corruption of the Italian word *girasole* (or sunflower), the blossom of which it closely resembles, except in size. It is a native of Brazil. It is propagated by means of its tubers, planted in the manner of potatoes, in rows 3 or 4 feet apart, and 15 inches between the tubers. It is not necessary that the whole should be lifted every year, and in order to save trouble and time they may be kept for years in the same place, by lifting for use every second row in alternate years, and returning to the same place at once the small tubers for another crop, at the same time working in a little manure to maintain the fertility of the soil. The planting should be done in spring, about August; they are not affected by slight frost.

It is, however, as a pig feed that they are most useful, although slightly less nutritious than potatoes, a much heavier yield is often obtained. When grown as feed for swine the best method is to plant them in a long, narrow, securely-fenced paddock, the pigs being allowed, when the crop is mature, to do their own harvesting. By having the paddock narrow, hurdles can be run across from side to side; then starting from the end where the shelter is situated, close off a portion. When this is thoroughly rooted up and all the tubers eaten, shift the hurdles further down, throwing another portion of artichokes open to be harvested, and so on till there is only a small patch left; this is harvested by hand and kept for seeding purposes. Artichokes are very hard to get out of land, and it is as well to keep the same piece under them for several years. The land best suited for their culture should not be too rich, or they run too much to top. A moist, loose soil or sandy loam suits them well. Cultivate to keep down weeds while young. The best crops are obtained by annual planting from selected tubers. The tops cured as hay make a good fodder for cattle, while sheep also do well on the roots, but of course cannot do their own harvesting as pigs can. Tubers are obtainable from any seed merchants from May to July.

"The Farmer's Cyclopedia of Agriculture" has the following to say with regard to artichokes as feed for pigs:—"The yield is usually greater than that of potatoes, varying from 275 to 1,000 bushels per acre. The tuber has nearly the same food value as potatoes, and is superior to turnips and mangel-wurzels for feeding purposes. Some trouble is occasionally experienced in inducing hogs to eat the tubers raw, but they soon acquire a taste for them. One acre of artichokes will keep from twenty to thirty hogs from April to the following December in good condition. They have been found an excellent substitute for a large part of the corn (maize) generally used in fattening hogs, both as regards growth and health. In feeding experiments with hogs that were given free run in the artichoke field, a pound of gain was made with each 3·1 pound of grain fed. In other experiments it was shown that about five pounds of grain were necessary to make a pound of gain.

The Poultry Industry.

H. V. JACKSON,
Export and Cold Storage Branch.

VERY little appears to be known by the general farmer of the business done in eggs and poultry, so far as the importer and exporter are concerned, and, therefore, with the object of ascertaining something of the position of affairs, the Collector of Customs at Sydney was recently requested to favour the Department of Agriculture with some particulars, if they were available; and, in response thereto, a communication has now been received, giving the returns for the years 1903, 1904, and 1905, showing the Imports and Inter-State transfers into New South Wales of live poultry, frozen poultry, and eggs, and also showing the Exports of similar products from New South Wales.

It may come as a considerable surprise to many people in the trade to read that some £4,000 worth of live poultry is imported yearly. The total values are as follows:—

Imports.	Live Poultry.	Frozen Poultry.	Total.
	£	£	£
1903	3,888	2,614	6,502
1904	4,487	764	5,251
1905	4,432	181	4,613

Notwithstanding the large production of eggs locally, there is an astonishing importation of this product of the hen, the total value being as follows:—

Imports:—Eggs—1903, £39,470; 1904, £43,824; 1905, £37,752.

The total importations, therefore, of poultry and eggs have been as follows:—

1903, £45,972; 1904, £49,075; 1905, £42,365.

Coming to the export side of the business the values are as follows:—

Exports.	Live Poultry.	Frozen Poultry.	Eggs.	Total Value.
	£	£	£	£
1903	323	2,535	1,949	4,807
1904	776	399	442	1,617
1905	1,633	4,854	789	7,276

From the particulars above it is very evident there is immense scope for enterprise in the direction of meeting the demands of the local market for eggs, quite irrespective of the export trade, and while catering for the local egg market the production of exportable birds of the right stamp and in sufficient quantities should go hand in hand.

The returns show clearly who are our largest customers abroad at present, and from whom this State receives its most extensive supplies in the products under review.

RETURN showing the Imports and Inter-State Transfers into New South Wales of Live Poultry, Frozen Poultry, and Eggs, during the years 1903, 1904, and 1905.

Whence—	Live Poultry.						Frozen Poultry.						Eggs.					
	1903.		1904.		1905.		1903.		1904.		1905.		1903.		1904.		1905.	
	No.	£	No.	£	No.	£	lb.	£	lb.	£	lb.	£	doz.	£	doz.	£	doz.	£
Victoria	6,788	1,005	868	480	501	265	29,358	1,472	9,480	463	5,130	171	17,248	822	22,718	731	42,606	1,128
Queensland	242	62	210	122	116	69	3,468	175	...		120	4	66,871	2,964	216,363	5,912	293,364	7,117
South Australia	2,440	2,081	10,960	2,698	12,533	2,952	219	10	968	47	...	.	726,225	24,014	1,016,218	25,077	1,101,478	29,108
West Australia	...	..	...	..	15	10	.	...	...	..	...	...	......	...	....	...	....	...
Tasmania	90	71	12	23	133	77	993	50	...		..	...	182	41	280	9	10	12
New Zealand	40	54	131	145	88	103	12	1	228	12	..	...	......	...	....	...	28	3
United Kingdom	75	394	110	725	208	801	15	1	..	...	96	4	10	2	78	13	4,176	131
Canada	..	...	...	.	...	...	19,791	783	2,023	98	...	..	......	...	....	...	....	...
Natal	..	.	..	.	...	...	..	...	2,920	143	..	...	.. ...	...	......	..	....	...
China	..	...	..	...	...	..	36	2	...	..	60	2	111,587	1,524	65,005	847	1,056	21
Hongkong	.	..	.	..	...		..	...	...	...	..	..	..	...	81,890	1,104	1,754	30
Germany	12	7	...	...	..	...	...	...	...	..	.	...	. ...	...	28	1	6,511	182
Japan	...	...	...	..	.		1,708	60	..			..	..	...	.. ..	..	1,224	20
New Hebrides	2	1	...		..	..	..	...			...		.	...	... .	...	....	...
United States	140	213	160	294	63	155	880	48	15	1	...	...	2,010	93	240	100	....	...
Totals	9,829	3,888	12,451	4,487	13,600	4,482	56,480	2,614	15,634	704	5,406	181	924,603	39,470	1,402,820	43,824	1,452,207	37,752

RETURN showing the Exports of Live Poultry, Frozen Poultry, and Eggs from New South Wales during the years ended 31st December, 1903, 1904, and 1905.

To—	Live Poultry.						Frozen Poultry.						Eggs.					
	1903.		1904.		1905.		1903.		1904.		1905.		1903.		1904.		1905.	
	No.	£	No.	£	No.	£	Pairs	£	Pairs.	£	Pairs.	£	Doz.	£	Doz.	£	Doz.	£
New Zealand	156	64	462	545	1,747	1,343	...	...	...	...	8,139	1,638	12,759	578	7,958	355	4,996	426
United Kingdom	...	...	...	...	...	...	86	30	...	...	...	...	220	9	683	24	2,190	76
Canada	...	...	...	...	...	...	...	...	...	...	...	...	300	24	...	...	...	...
Cape Colony	70	5	8	20	...	...	91	41	...	...	2,388	501	11,350	656	...	...	1,341	52
Fanning Island	...	...	...	...	...	...	...	...	...	...	...	...	...	...	24	1	132	10
Fiji	110	30	143	32	145	35	...	...	...	...	...	...	...	...	408	14	148	6
Hongkong	...	...	...	...	49	5	...	...	...	...	507	227	130	3	...	...	525	19
India	...	...	3	5	...	...	...	...	...	...	...	...	...	...	...	...	50	2
Natal	100	7	3	5	...	...	5,947	1,602	422	124	4,197	1,175	14,036	609	1,156	33	...	...
New Guinea	191	23	31	8	238	65	...	...	...	...	...	...	...	...	...	...	150	6
Ocean Island	...	...	...	...	...	...	...	...	...	...	...	...	72	5	69	2	...	...
Norfolk Island	44	11	6	1	...	...	...	...	...	...	...	...	20	1	...	...	...	...
Straits Settlements	...	...	...	...	...	...	...	...	...	...	1,029	313	...	...	...	...	...	...
Caroline Island	4	2	2	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Chile	...	...	...	...	30	4	...	...	...	...	...	...	...	...	...	...	135	6
France	...	...	...	...	...	...	...	...	...	...	212	43	...	...	...	...	2,110	105
Germany	...	...	...	...	...	...	...	...	...	...	24	6	...	...	...	...	42	2
Japan	...	...	...	...	48	6	...	...	...	...	...	...	...	...	...	...	15	1
Java	...	...	25	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Kaiser Wilhelm's Land	...	...	12	3	6	3	...	...	...	...	...	...	...	...	...	...	...	...
Marshall Islands	158	30	51	14	99	22	...	...	...	...	...	...	72	4	24	1	...	...
New Britain	51	18	59	17	19	6	...	...	...	...	...	...	...	...	...	...	49	2
New Hebrides	...	...	89	23	119	23	...	...	...	...	...	...	...	...	...	...	...	...
New Caledonia	74	41	143	91	478	67	...	...	...	...	...	...	850	59	27	3	1,148	62
Philippine Islands	...	...	...	...	64	9	4,481	862	614	275	1,394	908	...	...	...	...	116	5
Portuguese East Africa	50	23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
South Sea Islands	284	69	36	7	225	39	...	...	...	...	...	...	25	1	143	6	154	6
United States	...	...	...	...	12	1	...	...	...	...	...	...	...	...	...	...	67	3
Total	1,292	323	1,076	776	3,335	1,633	10,605	2,535	1,066	399	17,890	4,854	40,474	1,949	10,497	442	13,368	789

Celery (*Apium graveolens*).

JOHN HALSTED.

One of the most useful culinary vegetables is celery. There are three distinct varieties—the Solid White (a late variety), the Manchester Red (a hardy winter variety), and the Celeriac (turnip-rooted soup variety). Celery is used as a green vegetable, for salads, and for flavouring soups, &c.

Soil.

The soil required for the culture of celery should be a deep, friable, fairly rich loam. It is a good rotation for cauliflower. Cauliflower requires heavy, rich cultivation, consequently the manure has become assimilated. Pure sand or stiff, clayey loam are almost useless for its cultivation. The crop from such grounds would only be fit for flavouring, and the growth would be stunted and mostly stalks.

Situation.

The position should be an open, damp one, not too exposed, well drained, and not under a fence or building where there is refraction. Being of a succulent nature it will require a liberal supply of water, so the closer it is planted to the water supply the less will be the haulage.

Sowing the Seed.

As it is an autumn and winter vegetable, it should be sown in summer, either November or December, but not later than January. The seeds are fine, so they will require a fine seed-bed. A mixture of open sand, leaf mould, rotten cow manure, with a little lime, well sieved through a fine sieve, will suit them best. The seed should be sown in boxes about 4 inches deep, having the ends half an inch lower than the sides for ventilation. Holes should be bored at the bottom of the boxes to allow the water to percolate, and prevent souring. Over the holes a layer of crocks should be placed; over the crocks a layer of small dry leaves, then a layer of not too fine charcoal, and then the prepared soil. Level the surface, press it down firmly with a piece of board, and sow the seeds sparingly and evenly. Cover the surface with free sand, and water lightly with a fine rose. The box should be kept in a warm position, covered with glass, and never allowed to get dry. As soon as the seeds appear above ground lift the glass a little each day. When the seedlings are 1½ inches high, the glass in the day-time may be removed. This will gradually acclimatize them, and get them ready for transplanting.

Size of Seedling for First Transplanting.

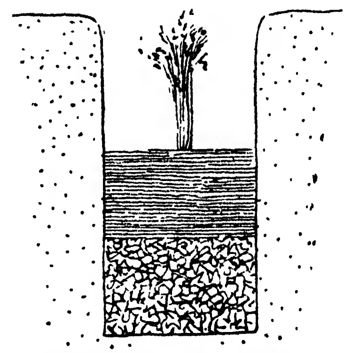
Transplanting.

The seedlings require two transplantings. The first should be into boxes, previously filled with prepared earth, as soon as the second leaf appears.

Keep the plants from excessive exposure of wind and sun until they are about 3 inches high. They are then ready for the second transplanting.

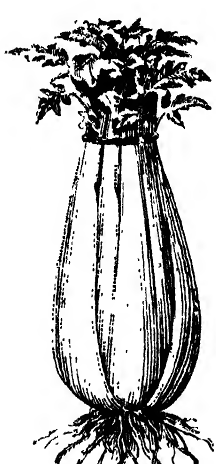
Culture.

The bed, or rather trench, for their permanent growth should be dug out to a depth of about 2 feet and 15 inches across. The earth from the trench should be placed evenly on each side. Three inches of coarse ashes should be placed at the base for drainage; on the ashes a 2-inch layer of well-rotted stable manure, then about 3 inches of good earth and another layer of manure. The two latter should be well dug. Place over the whole about 4 inches of good soil, and tread lightly to make the bed firm.



Section of Trench, with Seedling Transplanted.

In this the seedlings should be planted all of equal size. To insure the plants growing they should be placed, previous to planting, in some thick, liquid, fresh cow manure for about half an hour, pinching off a portion of the roots and leaving a little more than an inch. Form the holes with a dibbler, about 9 inches apart, water them, and insert the plants. Press the earth firmly round the roots, and water lightly. The plants should be shaded for a few days until well established. This can be easily done by placing some pieces of stick across the trench, and laying on some old bags or boughs. Watering should take place night and morning with well ærated water from a fine rose watering-can. Never allow the earth to enter the heart of the plant or the surface to get dry. Use liquid manure to the roots only once a week, not alone, but after a good supply of other water. The secret in growing celery is to keep it growing.



Celery Plant, showing Method of Tying previous to Earthing.

Earthing.

Earthing is banking the soil against the plant. Defer this till as late as is possible. The object of earthing is to bleach the stems to make them keep tender, and to keep the frost off. Previous to earthing, tie the leaves together at the top with raffia or green flax. This prevents the soil from entering the heart. Before earthing, place some straw, dry grass, or litter next to the stems to prevent contact of plant with the soil. The strong soil is apt to rust the plant.

Diseases and Enemies.

The "Farmers' Cyclopedia of Agriculture" gives the six following diseases and enemies :—

Leaf Blight (Cercospora apii) forms numerous pale spots on the leaves; they turn yellow and die unless the disease is checked. The disease may be controlled by spraying with Bordeaux mixture.

Leaf Spots (Phyllostica apii) are brown in colour and larger in size than leaf blight. This disease may be stopped by early applications of Bordeaux mixture.

Blight (Septoria apii) causes affected leaves to become wholly brown with small black specks over the surface. The whole plant may become affected except the root. The disease is most injurious in seed-beds, and is often spread by means of affected seed. Either Bordeaux mixture or ammoniacal copper carbonate may be used at its earliest appearance.

Rust (Puccinia bullata) affects a great variety of the parsley family. It appears in the form of small brown warts. Pick the diseased leaves and burn them. The disease can be checked with diluted Bordeaux mixture.

A bacterial disease affects some varieties, and often spreads to the stalks. Spray as for blight.

Celery caterpillar (Papilio asterias) is the larva of a butterfly which deposits its eggs on the leaf. Hellebore or pyrethrum may be used for killing these caterpillars. Celery is often attacked by the cabbage plusia, leaf miners, tarnished plant bug, &c., but not in a serious manner.

Applications of a good dusting of soot cause the butterflies to pass on.

Canker or rot is caused by a check to growth or injury to stems. They turn rusty in colour and decay. This naturally spoils the appearance of the stems.

Report from the Agent-General.

The Agent-General for New South Wales in London has recently reported on some complaints that are made in Bradford, and other woollen textile manufacturing centres, as to the presence of vegetable matter in wool.

Mr. Coghlan says :—

"Owing to the courtesy of the Managing Director of what is generally regarded as the largest wool-scouring, combing, and carding establishment in England, with branches on the Continent, Mr. Clarke was enabled to inspect bulk lots of wool as received for scouring, and see it in all the processes of sorting, scouring, carding, and combing, from which last-mentioned process the wool passes into the hands of the spinners and manufacturers. Mr. Clarke reports as follows :—

'In the sorting-room the bales are opened and the contents spread upon tables and sorted by men exclusively engaged in that class of work. At this stage pieces of hemp string, clumps of jute, odd scraps of vegetable matter, twigs, thistles, big burr clumps, and even (as will be observed in samples previously forwarded) fragments of horse-hair are culled out. At the scouring troughs any discernible pieces of foreign matter which have escaped the sorters are gathered.

'In the carding machine the scoured wool passes over teeth to lay the fibres parallel, and in this process the majority of burrs and seeds are removed. In the combing, which is done to separate all the longer fibres of wool 'tops' from the short and broken fibres, more seeds and scraps of vegetable matter are removed and are swept by the process into the mass of fibres called noils, which are too short for spinning, and which are submitted to a chemical process for the removal of vegetable matter.

'It will thus be seen that the impurities which are amenable to treatment comprise burrs, seeds, scraps of grass, twigs, &c., gathered in the fleeces by almost uncontrollable means, with scraps of string, horse-hair, straw, and other matter, easily traceable to some carelessness on the part of those who pack the wool; but of more importance than any of the foregoing are the minute shreds of hemp from strings of jute from the pack, which escape detection by the sorter, and in the processes of scouring, carding, and combing, are so inseparably commingled with the tops that they pass into the yarn and cloth. Then, as the shreds of jute remain unaffected by wool dye, they become, for the first time, visible, and substantially reduce the value. In fact, for certain classes of cloth, wool containing these impurities cannot be employed, and, although it may be of the highest class, must be regarded by the buyer as of a lower grade.

'The foregoing refers to wool shipped in the grease, but, in the course of inspection, a bale of New South Wales scoured wool which was being opened up was found to contain throughout every handful tried, particles of cotton thread. The Managing Director of the works said such wool was practically useless for the manufacture of cloth, or any high-class purpose, and was depreciated to the degree of being almost unsaleable at any price. In his opinion, the presence of the threads throughout this wool was probably due to a calico foundation having been used on the scouring-trough rollers, and as it had become worn and rotted the particles had come away with the wool passing between the rollers. The practice in Bradford is to use wool throughout for the rollers.

'It is claimed by several buyers and manufacturers that, now, there is a greater quantity of the vegetable matter that passes into the yarn and warp than in former years. The handling and packing of wool in New South Wales sheds can scarcely have undergone sufficient change during the last few years to furnish adequate reason why this should be the case, but the principle growing more prevalent each year in scouring establishments of expecting sorters to get through specified quantities of wool, and consequently working more hurriedly, does appear to be open to inquiry, as suggesting at least one reason why the manufacturer finds in his tops more objectionable matter than formerly.

'The Bradford Chamber of Commerce, while urging the necessity for increased vigilance on the part of those responsible for the rolling and packing of fleeces to avoid the inclusion of scraps of straw, grass, string, or other foreign matter, incline to the opinion that much benefit would result from more care in cutting open the bales. It has been suggested that the wool-

packs should be lined with paper so as to prevent detached fragments of jute from getting into the wool, and that the hempen string used for sewing up the bales should be dyed black so that any scraps of it which might get into the wool would be more readily detected.

'As far as it is possible to judge from the views expressed by those who have most to do with the wool, it appears that there are a great many serious objections, apart from expense, to the paper lining of wool-packs, especially in the case of New South Wales, where the bales are tied on waggons and trucks with ropes and are reduced to about one-third of their original dimensions in dumping for shipment.

'Another suggestion is that the packs be singed before use, so as to remove any shreds of the material that might become detached and adhere to the wool.

'One of the principal firms of wool-pack manufacturers in Bradford has for some time devoted much attention to means of improving wool-packs, with a view to getting over the difficulties referred to, and has made many experiments, such as paper-lining, dying black, &c., but without definite success. This firm has now adopted a wool-pack more closely woven than the ordinary ones, and with the outside as well as the inside surface quite smooth. These packs are made from a better class of jute yarn, and are specially prepared and polished in such a way that, it is claimed, no loose bits of jute can come off, no matter how long the wool is kept in them or what pressure is used when packing. The weight of these packs is about 10 lb. each, instead of 11¼ lb., as in the case of the standard pack now used, and the improved cloth, being more closely woven, is said to be equally as strong as the heavier kind. The increase in price is stated at about 6d. per pack.'

"Messrs. Whaley & Co., the manufacturers of this new wool-pack, are furnishing samples, which I will despatch to you in order that they may be placed on exhibition for the information of those interested."

A copy of the above report was recently sent to a number of firms interested in the wool industry; and with reference to the question of foreign matter in wool and wool-bales, a gentleman replies as follows:—

"Having seen a letter from you in reference to foreign matter in wool, and which is of great importance to me, I herewith take this opportunity of writing you. So far as vegetable matter, such as burr or grass seed, these, in my mind, it is practically impossible to guard against; but in reference to the jute fibres this can, and should, be rectified to a great extent with practically no cost to the grower. The present packs generally in use in New South Wales look, and are, exceedingly neatly finished on the *outside*, whereas on the inside it is one mass of ragged seams. Surely the easiest way and cheapest would be to turn the packs inside out, whereby at least there would be a 70 per cent. reduction, if not more, of jute fibre in the wool. Should you press this suggestion, you will find, I am sure, that it will be most practical, odd as it may look."

Reports from the Commercial Agents.

JAPAN.

REPORTING on the trade prospects in China, with special reference to Shanghai, Mr. J. B. Suttor, the Commercial Agent at Kobe, Japan, says, under date 18 January, 1906 :—

Horses.

"There is still an active demand for saddle and harness horses combined, also hunters. At Shanghai alone there is a certain market for at least 300 head per annum. The Shanghai market has not yet been properly tried with good upstanding carriage horses. I would certainly recommend a trial shipment of three or four pairs. Bays with dark points would appear the most in demand, but for all other horses it does not matter what the colours are so long as they are 14-1 to 15-1 hands high, and 5 to 8 years old.

"There is also a possibility of large requests being made for horses for the Russians in Northern Manchuria and Siberia, to be delivered at Vladivostok and Newchwang, but this business is not likely to eventuate until a more settled state of affairs is brought about at the places named. A leading Russian spoke to me on the business, and greatly admired the horses bought by the Japanese. When warmer weather sets in, I intend visiting Northern Manchuria, also Vladivostok, and will keep you advised as to the progress of events. I am also hopeful of obtaining orders for horses to meet requirements in Korea, where there would appear to be every hope of doing business at an early date.

Flour.

"I received many inquiries for New South Wales flour, and placed local agents in touch with Sydney interests. Every effort is being made to introduce our flour, and although the importations are so far only small, still the outlook is encouraging, and our flour spoken highly of.

"The matter of broken bags is now engaging serious attention in the East, and our people would do well to observe the following :—The Canadians, in particular, are paying close attention to deaden, as much as possible, complaints concerning broken bags, and are packing their flour in double cotton bags, then putting two 50 lb. sacks in one gunny bag. This system is coming greatly into favour, and also being adopted by some of the American millers. Local agents have informed me that they would rather pay a little more for the Canadian or American flour so packed than put up with

complaints and demands for compensation for broken bags under the old system. When unloading in the Orient the flour and other cargo is unloaded into lighters, and in numerous cases the goods get rather rough handling, and also a second handling when being unloaded from lighters. It would be well for our people to carefully consider the above, and endeavour to fall into line with the Canadian system. I regret to state that I received a very serious complaint from one of the large Shanghai merchants concerning Australian flour. It appears samples were submitted and the shipment ordered accordingly. On arrival it was ascertained that the flour differed much from the original samples, and the local merchant lost thereby. On making further inquiries, I ascertained the consignment came from Victoria, and much resembles a defective consignment referred to in my last Shanghai despatch. When a native buyer once finds a defective brand of any article, it is hopeless again attempting to introduce that particular brand. They thoroughly test every consignment, and specially note defects of any nature.

Butter.

"Australian butter is gradually coming more and more into favour. Recently an attempt was made to introduce American butter to one of the large importers of Australian butter, but, on trial, it was judged not to be equal to the New South Wales consignment, nor could it compare in flavour. Keep up the present standard of quality, and it is certain that New South Wales butter will hold the market against all comers.

Fresh Fruits.

"Further consignments have been received, but sent as deck cargo, and consequently arrived in defective condition. It is simply useless attempting to send fresh fruit to Shanghai, unless proper storage can be arranged, and the objectionable transhipping at Hongkong done away with. For good fruits there is a certain market at Shanghai, but not unless it can be landed in fairly sound condition."

South Africa.

The Minister for Mines and Agriculture is in receipt of a report from Mr. G. Valder, Commercial Agent for this State in South Africa, dated 24th January, as follows:—

"On the 16th instant I received a cable message as follows:—'Eggs fresh and pulped, can you inform us how the market is, if so please telegraph.'

"To this I replied, upon the 17th, as follows:—'Good demand for imported eggs at 9s. 6d. per 100, canned 7d. per lb., c.i.f. Capetown.'

"As I have already reported, large quantities of eggs are imported into South Africa, some being brought over as ordinary cargo, others in cold storage, and, of late, considerable quantities in cans.

"For some months past Canadian eggs have come in in fairly large quantities. These are packed in cases with cardboard fillers, exactly similar to some sent by a Sydney firm, which came here a few months ago. They are brought over in cold storage, and the merchants report that they were of excellent quality. Large quantities of eggs are also imported from Madeira, Denmark, and other parts of Europe. The quotations for these eggs have of late ranged from 9s. 6d. to 10s. 6d. per 100. Many of the eggs received from Europe are graded. The merchants report that the smaller grade is the most suitable egg for this market, that known as the 15-lb. egg being preferred—*i.e.* 100 eggs weigh 15 lb. These small-graded eggs are better for handling, and the buyers maintain that they keep better than the larger ones, even the 16-lb. egg being said to be too large.

"The Canadian Commercial Agent states that 7½d. per dozen, f.o.b. Canadian ports, is a fair price for their eggs; and the price quoted for European eggs is 7s. per 100, f.o.b. Southampton. The merchants are of opinion that Australian eggs could compete successfully with European and Canadian, and they are anxious to see trial shipments made. The consignment received some little time ago from Sydney opened up in splendid condition, but I am afraid that the consignee held them too long, and, as a result, when sold it was found that many of the eggs were rotten. I would certainly advise trying shipments in the three ways mentioned above, viz., ordinary cargo, cold storage, and in tins.

"If canned eggs of good quality can be placed upon this market, I believe that they will sell well. The manager of the largest bread, cake, and biscuit factory in Capetown told me recently that he found that the canned eggs he had received from Ireland, for which he paid 8½d. per lb., were equal to fresh eggs at 6s. 10½d. per 100, whereas 9s. 6d. to 10s. 6d. was asked for these latter, and that, therefore, he was using the canned as much as he possibly could."

Hints on Harness, and How to Preserve it.

Mr. A. Bothwell read a paper on this subject. For this climate he advised the use of brown leather, which was tanned without the addition of artificial colouring, whereas black leather is produced by the use of a dye into the composition of which iron enters largely, and which has a tendency to injure the surface of the leather. He had seen the surface of some leather peel right off, owing to the dye having gone too deep, or to neglect on the part of the tanner. To get a good leather it must be tanned properly; but this is often not as well done as it should be. However, with good leather and well-made harness, care and attention will keep it in good order for a long while.

The saddle and harness should not be hung up by the straps, or left out in the weather. There should be a proper place in the stable to keep it when not in use. [It is at all times better to hang harness, saddles, &c., in a room handy to the stable, but removed from the pernicious fumes that arise from the urine.—Ed.] If it gets mud on, scrape as much as possible off with a very blunt knife or piece of hard wood cut into convenient shape, then use warm water. The water must not be hot, and should be applied with a sponge or soft brush. Place the harness where it will dry—not too close to a fire—and give it a coat of neat's-foot oil or other animal fat. This will dry in and nourish the leather. Mineral or vegetable oil must not be used. A harness dressing, applied with sponge or clean cloth, will improve the appearance of the leather. The buckles, hames, and other parts made of nickel or German silver should be cleaned with polishing paste. Rub the tongues of the buckles with an oiled rag, as these are usually of iron. Buckle the collars, and where possible shift the straps occasionally, so as to buckle into different holes. Saddles should be cleaned with soft soap and water, using as little water as possible. Use brown composition when the saddle is dry. He had noticed a recommendation to soak new collars in water before putting them on, so that they will fit the horse's shoulders. He did not agree with this plan, as owing to the bulk of straw, it took a long time to dry once it was thoroughly soaked, and was likely to result in the stuffing rotting. Such treatment was unnecessary, as any practical tradesman could supply a collar to fit the horse without such injurious treatment. In regard to fitting collars, most horse-owners want a collar larger than necessary. For draught horses, the pipe collar was the best, as it is the shape of the horse's neck, whereas the round collar is not. A new collar should fit fairly tight, as it will get larger with use, whereas a collar that is too large cannot be made to fit without chafing the horse at some point. Collars lined with leather are better for buggy or other fast work, as the collar is cooler than cloth, though it requires more looking after, as if the sweat is not cleaned off the leather will most likely crack. Some people ask that the collar be lined soft; but this was a great mistake, as the firmer the collar, providing it fits the horse, the better. In regard to repairs, the copper rivet, properly used, was a very useful article. Often, however, they were used too long, with the result that the shank bends, and will not bear up as it should do. For joining two pieces of medium leather a $\frac{3}{8}$-inch rivet will do; but for stout leather, use $\frac{1}{2}$-inch rivets. A No. 4 saddler's punch, a piece of lead or hard wood to punch on, a rivet set, a cutting tool, and a hammer were all that were required for mending work. If hard wood is used for punching on, they must punch with the grain, or the tool will be spoiled. There were various other kinds of rivets, or staples, for mending harness; but, in his opinion, none equal to the copper rivet for strength and durability. In riveting the reins, the work must be well and neatly done, otherwise the rivets may catch in the terret or hames, and cause an accident.—*Journal of Agriculture, S.A.*

Orchard Notes.

W. J. ALLEN.

April.

During the last month there have been splendid falls of rain in almost every part of the State, and in consequence the land has been in good condition for sowing the seed of green crops or for giving the land a fall ploughing, where this is practised, after which it should be left alone until the spring ploughing, when the tares, gray field peas or other green crops and any weeds which have grown can be turned under before they seed.

Lime may be applied in cases where the soil is found to require it, particularly where it is sour or where it is very heavy or sticky. After making the application of lime see that it is well worked into the surface soil.

It is most important that our citrus growers should endeavour to rid their fruit of all scales, either by fumigating or spraying, and this with as little delay as possible, as even after the scale is killed it takes some time for it to leave the fruit, particularly after fumigation. Fumigating tables may be obtained on application to the Department of Agriculture.

Planting of citrus trees may be continued this month. When autumn planting is practised care should be taken in handling such trees not to expose the roots to either wind or sun for any length of time.

Codling moth bandages must still be kept on the trees as, even after all the fruit is removed, an occasional grub finds its way to the bandage. All props should be removed from the orchard and any grubs adhering to them destroyed.

It is very noticeable when removing bandages that those trees which are badly disfigured with woolly aphis are rarely found to have many moths under the bandages, but a close inspection of the knobs will disclose grubs in all of them and where this is the case, there is but slight hope of ridding the orchards or district of this pest. Where such trees are worked on blight proof stocks, it would pay to cut them down and graft to non-blighting varieties or where trees and roots are badly affected they might be rooted out.

The following varieties of apples are those found to be doing the best out of the four hundred varieties at present growing in our Wagga orchard.

Early.	*Mid-season.*
Early Joe.	Frampton.
Reinette Jaune Hative.	Yates Nonpareil.
Chemise de Soie Rouge.	Rome Beauty.

Late.

Missouri Pippin.	Statesman.
Granny Smith.	Prother's Winter.
Yates.	

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

Directions for the Month of April.

Vegetables.

Good rain generally over a large portion, if not the whole, of New South Wales during the autumn months, and such has been the case in March. April, therefore, is a good month to sow and plant vegetables, unless, of course, there be too much rain, and the soil is little better than a puddle. If the season is very wet, the less the ground is dug up or trodden about the better; although on some soils work may be carried on soon after a heavy shower; but these soils are the exception. The chances are that the month will be showery, but not over wet; and if so, almost any kind of work can be carried on.

Asparagus.—It is possible that towards the end of the month asparagus tops may begin to become discoloured, preparatory to dying away. When this occurs, the crops may be cut down to the ground and burnt. If they are cut down whilst green and berries unripe, sprouts may come up, should the weather be moist and warm, to the injury of the plants.

Broad Beans.—This is about as favourable a time to sow this vegetable as could be selected. If anyone has a choice of soils in his garden, let this bean be sown in the stiffest loam, and it should succeed best there. Plant the beans in rows about 4 or 5 inches apart, in drills 3 or 4 feet apart. When the drills are covered, the beans should be about 3 inches below the surface.

Beans, French or Kidney.—Should only be sown in the warm parts of the State near the sea coast, where early frosts are not likely to occur.

Beet, Red and Silver.—A very little seed may be tried if there are no plants in the garden. Seedlings which are coming up should be thinned out well as they advance. Silver beet may be transplanted from the seed-bed if the plants are large enough.

Borecole or Kale.—A little seed may be sown if this vegetable is required. This member of the cabbage group needs much the same treatment as the cabbage, and it will be found most suitable for districts with cool or cold climate.

Brussels Sprouts.—This is one of the best of the cabbages when well-grown. Sow a little seed, and plant out young seedlings which are available and large enough to move.

Cabbage.—Seed may be sown as largely as may be required. Seedlings that have already been raised may be pricked out for future planting. Use plenty of good manure for the cabbage and any of the same class. This manure should not, unless unavoidable, be used in a fresh, rank condition, but should have been well rotted.

Cauliflower.—Treat the same as cabbage, and keep the plants growing and in good health from start to finish by careful moving, thorough cultivation, and the application of water and liquid manure should the soil become very dry.

Carrot.—Seed may be sown largely of this useful vegetable. The seed had best be sown on land which had been heavily manured for some other kind of vegetable, such as cabbage. If fresh manure is used the carrots are liable to become forked and badly shaped. Sow in drills. These drills should be about 1 foot to 18 inches apart, and when the carrots come up thin out well. Try the Early Shorthorn, which is a small but good variety.

Celery.—Plant out a few well-grown seedlings in shallow, highly-manured trenches. A little seed may be sown.

Endive.—This is a useful substitute for lettuce, but rather bitter in taste. A little seed may be sown and any young plants already raised may be planted out. Manure the ground well, and keep the plants growing.

Leek.—Sow seed as largely as may be needed. When preparing soil for the planting out of sufficiently matured seedlings use abundance of manure.

Lettuce.—Sow seed largely, and plant out from seed-bed any young lettuce large enough to shift.

Onion.—The land for the onion should be heavily manured with well-rotted manure, unless naturally very rich, and steps should be taken to drain well at the time of digging. Sow seeds largely in rows during the month. When the seedlings appear look well after them, and do not permit any weeds to grow amongst them.

Parsley.—Sow a little seed if any more plants are required.

Peas.—Sow largely during the month, for the peas should succeed very well almost anywhere just now

Radish.—Sow a little seed from time to time as required. Use well rotted manure, and abundance of it.

Spinach.—Sow a little seed in rows about 18 inches apart, and thin out the seedlings well when they are large enough.

Shallots.—Plant out a few cloves, but avoid deep planting.

Herbs.—Sow seeds, or plant cuttings already raised.

Flowers.

Cuttings of many kinds of plants may be rooted well during the month of April. Chief amongst the plants to be propagated is the rose, and growers of this flower generally desire to raise a good many plants, either to grow themselves, give away, or exchange. The chance of a good time of year to obtain rootings should not be lost. Cuttings, also, of the carnation should root very well during the month; verbena, fuchsia, pelargoniums, and many other plants can easily be propagated from cuttings now. Clean sharp sand is the best medium in which to insert the cuttings, most of which had better be rooted in boxes, seed-pans, or pots. The roses will be best raised in beds, in a sheltered place in the garden.

Seeds of all kinds of hardy annuals may be sown during the month in boxes, seed-pans, or pots, or other vessels, such as kerosene tins, &c. As soon as the seedlings are large enough to move they can be pricked out, and afterwards planted in the garden.

Perennials and all sorts of evergreens may be planted early in the month.

Farm Notes.

Hawkesbury District—April.

H. W. POTTS.

The existing moist autumn conditions are most favourable for getting the land into good tilth for the early winter crops. Where stock have to be provided for, the warm state of the soil and ample moisture are useful to create rapid germination. Everything points to strenuous work on the farm. The return of good seasons is evidently assured, and the most encouraging prospects from a farming point of view are ahead.

Wheat.—In this district the most reliable returns are obtained from hay-crops, and for this purpose the most suitable varieties to sow are White Lammas, Tardent's Blue, Jade, and Blount's Lambrigg. Seeing this district is notorious for rust, it is not wise to sow for grain, excepting such varieties as have been tested and proved largely rust-resisters. Amongst the best are Bobs and Nut-Cut. The macaroni or bearded wheats invariably give good returns. Medeah and Beloturka have always proved excellent yielders.

Barley.—Successive sowings of barley may be continued; and where green forage is required in the earlier part of the winter, this crop may be relied upon, particularly Cape Barley or Skinless. For dairy cattle, barley is best sown with tares or peas. These combinations provide a more relishable fodder, and, moreover, ensure a better balanced ration for milk production.

Oats.—Algerian oats have proved the most satisfactory in the past, and given a crop freer from rust than the other sorts, such as Tartarian, Dun, or Potato. It is found that when early sown the best returns are obtained; and, apart from this, experience proves that the early sown crop invariably is harvested before the weather is sufficiently warm to develop rust. As with barley, in the case of growing for green forage, the addition of tares or peas provide a suitable ration, rich in protein.

Rye.—Two varieties of rye have always given satisfactory returns in the past, viz., Emerald and Thousandfold. This crop, as green fodder, is very useful; and as it will grow well on light, sandy soils, and with less plant-food than is required by other crops, it is especially indicated in many parts of the district. In fact, it is known to give good yields on the poorest of soils. The plant is very hardy, palatable to stock, and comes in early, provided the seeding is conducted this month. Where it is required for grain, the value of the straw is a consideration for bedding. The grain is suitable for pig-feed.

Turnips and Swedes.—After getting the land into a fine state of cultivation, and with ample moisture, the main crops should now be sown. It is to

be remembered that turnips and swedes have an important influence in the rotation, and, when fed off with sheep, the soil is restored to a normal condition of fertility. Occasionally, the market returns are profitable for this crop; but in any case it is a payable one as fodder for sheep, pigs, and cattle. The best varieties to grow are Sutton's Magnum Bonum, White Pomeranian, Purple-top Aberdeen, Green-top Aberdeen, and Purple-top Swede.

Mangolds and Sugar Beets.—These are invariably grown in summer, but when the weather conditions are favourable as at the present, good yields may be grown in autumn for dairy cattle. They form a very relishable and succulent form of fodder.

Carrots and Parsnips.—These may be sown now for a winter crop for stock.

Sheep's Burnet.—This forage plant may now well be regarded as a valuable addition to those especially suitable for sheep. It possesses in a marked degree the power of resisting drought, and it is good practice to get a well-grown reserve in hand for periods of scarcity. It thrives well on poor soils, particularly so in limestone formations. Its habit of growth renders it competent to resist drought. The tap-root descends for moisture and food to a great depth.

Jersey Tree-kale, Thousand-headed Kale, and Cattle Cabbage.—Plants of these useful and valuable fodders may be raised in seed-beds and transplanted later on. The Jersey Tree-kale succeeded very well in this district last winter, and is worthy of more extended trials.

Kohlrabi may be sown this month also.

Rape.—Few plants grown as catch crops deserve as much real attention from the Australian farmer as rape. It may be classed amongst the most easily grown, succulent, relishable, and nutritious of fodders. The best variety is that known as Dwarf Essex. Eight weeks from the time of sowing with favourable weather, the crop is full grown and ready for stock or cutting. It will grow to the height of 18 to 22 inches, and it has a root system specially suited to search at considerable depth for sustenance. It is relished by horses, cattle, sheep, pigs, and poultry. The food value of rape is as high as lucerne or clover. It has been grown here up to 15 tons to the acre, and even this yield could be increased by special attention in the use of fertilisers and good soil. It will grow well in any soil. It may be recognised as one of the best catch crops, and occupying a valued position in the rotation. Apart from the qualification of restoring soil fertility, it has the additional advantage of being one of the best cleaning crops for foul land. A fine, well-cultivated seed-bed is essential to a quick and luxuriant growth, and it is better drilled than sown broadcast so as to be able to destroy weeds by cultivation. When sown, have the land well rolled. The quantity of seed may be 3 lb. per acre.

Clovers.—Amongst the most certain and sturdy growers in the large family of clovers, none stands our climate more surely than the White Dutch perennial clover (*Trifolium repens perenne*). It survives the most trying periods of heat and drought, and is hardy enough to resist the

influence of couch and other coarse forms of grasses. It is the most certain of all the clovers to retain a permanent place in the pastures of either native or introduced grasses. One pound of seed to the acre will provide a useful addition to any mixture. With the advent of drooping or moist seasons, we may expect that such a splendid fodder clover as the perennial Red Clover or Cow Grass (*Trifolium pratense perenne*) may be successfully introduced into many of our pastures. The root of this plant reaches down into the subsoil, and renders it proof against drought to a large extent. This habit of penetrating to good depths enables it also to exist on poor land. It is naturally robust, succulent, and palatable. On rich land its growth is heavy and luxuriant. It may be included in laying down pastures with *Paspalum dilatatum*, rye grass, prairie, cocksfoot, Texas blue, and other grasses.

Lucerne.—The main sowing of the season for this very valuable fodder should be arranged now. No plant gives such profitable returns as a fodder for stock. It is relished by horses, cows, sheep, swine, and poultry, at all times. The effect of feeding lucerne on young animals is marked. It promotes a vigorous and hardy growth.

The dairy-farmer doubtless reaps the greatest benefit from lucerne for his stock. Sandy loams and readily penetrable soils of good depth afford helpful conditions for the vigorous growth of lucerne. The subsoil should be free and deep, with facilities for holding moisture. Deep cultivation is required. A well-tilled seed-bed, clean, fine and moist, are to be aimed at. The manurial needs of the crop are to be considered. In every case a dressing of lime is an advantage some time prior to sowing; with the seed may be added a complete manure or artificial fertilisers. The quantity of seed, sown broadcast, may range from 15 to 20 lb. per acre.

Bathurst District.—April.

R. W. PEACOCK.

Wheat.—Generally speaking, April is the best month to sow this cereal, and as much as possible should be put in. By sowing early the plants develop a vigorous root system before the cold weather sets in, which is of great importance if the winter should prove cold and wet. In such winters the root development is much less than when the soil is not soddened by excessive moisture. It is preferable to sow those requiring a lengthy season first; the early maturing varieties could be sown later. It is wise to sow the poorer portions of the farm earliest in the season, as the richer areas are warmer and the growth much greater throughout the winter months. By sowing early less seed is required per acre than if sown late. Less seed is also required when drilled than if sown broadcast. A half-bushel per acre drilled is sufficient for the early sowings, and 45 lb. for the later. If broad cast, these figures should be increased to 45 and 60 lb. per acre.

Oats.—Can be sown freely this month; they are mostly left until the teams can be spared after putting in the wheat, and perhaps this is the better practice. Wherever practicable, it would be better to sow earlier than is the usual custom, especially if good grain is required. In this district dry summers are the rule, and, generally speaking, the early and mid-season varieties are the best. Algerian is one of the earliest and best. Of the mid-season varieties, Carter's Royal Cluster, Surprise, Peerless White Bonanza, Abundance, and Potato are most suitable.

Barleys.—Should be sown largely for grain, and also for green fodder. They yield large quantities of grain, which is valuable for pig feed and other purposes. For malting, Standwell seems to suit the conditions of this district best. For feed grain, Cape and Skinless are valuable, as well as for green fodder. The Skinless does not stand the cold winters as well as the Cape, especially for green fodder. It is earlier than Cape, and for this reason is valuable. They require soils in good condition.

Rye.—This crop thrives upon poorer soils than the other cereals, and is valuable for green fodder. It also withstands very cold weather. For these reasons it is a valuable crop for poor soils in cold districts. It stands grazing well, and is well worthy of more attention as a winter fodder. Black Winter and Arctic varieties are most suitable for early winter fodder; White and Broad Leaved are mid-season varieties. Emerald is the latest, and it is more suitable for cutting in the spring, at which season it provides the greatest amount of most acceptable fodder.

Lucerne.—This is a very suitable month for sowing this valuable fodder crop. It thrives best upon the rich alluvial soils. It is also a profitable crop for grazing upon the light uplands, upon which it should be grown more extensively. It being a perennial crop, it well repays a thorough preparation of the seed-bed. It is better to sow without a cover crop, as in this district there is rarely sufficient moisture to allow of two crops thriving at the same time upon the same land.

Field Peas and Black Tares.—These are valuable in rotations, and should be grown for this reason, and for stock food. They should be sown early in the month. Black tares are more suitable than the peas for this district.

Scarlet Clover.—This should be sown early in the month. In common with the peas and tares above mentioned, it is a suitable medium by which nitrogen is added to the soil. For this reason, and also its value as a fodder, it is a desirable crop in a rotation with wheat and rape.

Linseed.—This crop should receive attention for its seed, such being excellent food for stock. It can be sown throughout the month on well-prepared soil which is in good heart.

Sheep's Burnet.—This should be sown during the month. It is a deep rooter, hardy, and suitable for light soils. It makes excellent sheep food.

Riverina District—April.

G. M. McKEOWN.

Wheat.—The recent rainfall has made possible the preparation of large areas of land which until a few days ago has been too hard for ploughing. The work of preparing land should therefore be pushed forward without delay, so as to ensure early sowing of cereals. March is one of the best months for sowing for hay, but conditions are favourable to the end of April. The heaviest crops and the most palatable and nutritious hay have been obtained on the farm from white wheats, such as Zealand, White Essex, Australian Talavera, and White Lammas. Marshall's No. 3 is the best of the purple straws, as most of the others have straw which is of light weight, and all are liable to bear a good deal of dead flag. In all cases fertilisers should be used, and it is preferable that they be drilled in with the seed, the latter being sown at the rate of 45 lb. per acre. During the month sowing for grain crops should be commenced, but all such work should be completed by the end of May, as late sowing has been proved unprofitable. The most successful variety during seven years' systematic trials has proved to be Farmers' Friend, with Hudson's Early Purple Straw next during six years. For four seasons Federation has been slightly in the lead. For bunt the best treatment has been found that of immersing the seed in a 2 per cent. solution of sulphate of copper (that is, 1 lb. sulphate of copper to 5 gallons of water). Immersion for five minutes is sufficient for ordinary varieties of wheat, but care should be taken to avoid varieties which are especially liable to the attacks of bunt.

Barley.—Should be sown for green fodder without delay, and for grain production sowing should be completed by the middle of May. For green fodder sow the skinless or awnless variety, as bearded cereals should not be used in any form as fodder for stock. For greenstuff sow ¾ bushel of seed to the acre. For grain crops sow 25 lb. to 30 lb. of seed with the drill. In all cases fertilisers should be used.

Peas.—Sow field varieties, also others at intervals for table use. Yorkshire Hero will be found one of the best.

Crown Lands of New South Wales.

THE following areas will be available for selection on and after the dates mentioned :—

FOR CONDITIONAL PURCHASE LEASE.

Name of Land District.	Total Area.	No. of Blocks	Parish.	County.	Capital Value (per acre).	Date available.
	acres.				£ s. d. £ s. d.	
Bombala . .	971	10	Bombala . . .	Wellesley	1 15 0 to 3 10 0	17 May, 1906
Grafton .	75½	1	Bagawa	Fitzroy ..	2 0 0	12 April, 1906
Lismore	353	2	Terama	Rous	1 15 0 ,, 2 0 0	19 ,, 1906
Murwillumbah	7,378	26	Burrell, Tyalgum, and Mooball.	Rous	1 10 0 ,, 2 10 0	19 ,, 1906

FOR ORIGINAL CONDITIONAL PURCHASE.

Land District.	Name of Holding, &c.	Total Area.	Parish.	County.	Price per Acre.	Date available.
		a. r. p.			£ s. d.	1906.
*Albury .	....	448 0 0	Creighton .. .	Hume .	3 0 0	24 May.
*Dubbo .	With suburban boundaries of Peak Hill	204 0 0	Mingelo .. .	Narromine ..	3 0 0	26 Apr.
Grafton .	....	1,300 0 0	Moonee .. .	Fitzroy .	1 0 0	24 May.
Muswellbrook.	....	58 0 0	Balmoral .. .	Hunter ..	1 15 0	3 ,,
*Narrabri .	Within suburban boundaries of Wee Waa.	43 3 12	Wee Waa .. .	White .	7 0 0 to 10 0 0	5 Apr.
*Tamworth .	Within suburban boundaries of village of Moore.	429 0 0	Woolomal and Attunga.	Inglis ..	5 0 0	10 May.

* Identical with Special Area, see page 420.

For Original Conditional Purchase or Conditional Lease.

Land District.	Name of Holding, &c.	Total Area.	Parish.	County.	Price per Acre.	Date available.
		a. r. p.			£ s. d.	1906.
Carcoar ..	....	660 0 0	Gillendich	Georgiana ..	0 15 0	17 May
Corowa ..	Kentucky Holding	696 0 0	Kentucky . ..	Hume ..	1 6 8	12 Apr.
Corowa .	....	513 2 0	Osborne .. .	" ..	2 0 0	12 "
Corowa ..	Quat Quatta Holding.	180 3 0	Lawes	" .	2 10 0	19 "
Corowa ..	Kentucky Holding	393 0 0	Kentucky .. .	" ..	2 0 0	19 "
Gosford ..	....	80,000 0 0	Cowan, Narrara, Koree, and Popran.	Northumberland.	0 10 0	12 "
Goulburn .	....	1,000 0 0	Yalbraith . .	Georgiana ..	Price to be fixed by Local Land Board.	17 May
Gunnedah .	....	170 0 0	Gunnedah .. .	Pottinger ..	3 0 0	3 "
Lismore ..	....	80 0 0	Broadwater .	Rous .	2 0 0	17 "
Muswellbrook.	....	208 0 0	Caroora .. .	Hunter ..	1 6 8	10 "
Tenterfield ..	Tooloom and Woodenbong Holdings.	200 0 0	Kangaroo	Buller .	Price to be fixed by Local Land Board.	12 Apr.
Wagga Wagga	Gobbagombalin and Tooyal.	370 0 0	Currawananna	Bourke .	1 15 0	3 May
Wellington .	....	120 0 0	Micketymulga .	Lincoln	4 0 0	3 "

For Ordinary Conditional Purchase or Conditional Lease.

Glen Innes .	....	480 0 0	The Brothers and Newton Boyd.	Gough and Gresham.	1 0 0	24 May

Special Areas.

Albury Land District, parish Creighton, county Hume, 448 acres in two blocks, maximum and minimum area 224 acres, situated about 3 miles from Culcairn Railway Station; good agricultural land, loamy soil with clayey subsoil; open forest; timbered with box and a little gum; sufficient water in Billabong Creek, in ordinary seasons. Price, £3 per acre. Available 24th May, 1906.

Dubbo Land District, parish Mingelo, county Narromine, 204 acres in four blocks, maximum area, 56¾ acres; minimum area, 47¼ acres; situated within the suburban boundaries of Peak Hill and 1 mile from that town; red and black soil; partly plain and partly thickly timbered with box and oak, box suckers and seedlings. The plain country is broken with gilgais, and hardly suitable for agriculture; water in some of the gilgais, but not permanent. Price, £3 per acre. Available 26th April, 1906.

Narrabri Land District, with Wee Waa suburban lands, 43 acres 3 roods 12 perches, in nine portions, in parish Wee Waa, county White; maximum area, 6 acres 1 rood; minimum area, 2 acres 2 roods 34 perches. Price, £7 to £10 per acre. Available 5th April, 1906.

Tamworth Land District, with the suburban boundaries of village of Moore, 429 acres, in five blocks, in parishes of Woolomal and Attunga, county Inglis; maximum area, 135 acres; minimum area, 58¾ acres. Price, £5 per acre. Available for Original Applications only, 10th May, 1906.

AGRICULTURAL SOCIETIES' SHOWS.

1906.

Society.	Secretary.	Date.
Cooma P. and A. Association	C. J. Walmsley ...	April 4, 5
Bathurst A., H., and P. Association	W. G. Thompson	„ 4, 5, 6
Warialda P. and H. Association	W. B. Geddes ...	„ 4, 5, 6
Richmond River A., H., and P. Association (Casino)	E. J. Robinson ...	„ 5, 6
Royal Agricultural Society of New South Wales ...	H. M. Somer . .	„ 11 to 19
Hunter River A. and H. Association (West Maitland)	C. J. H. King ...	„ 24 to 28
Orange A. and P. Association	W. Tanner ...	„ 25, 26, 27
Wellington P., A., and H. Society	A. E. Rotton ...	May 1, 2, 3
Upper Manning A. and H. Association	Edw. Rye... ...	„ 3, 4
Moree P. and A. Society...	S. L. Cohen ...	„ 8, 9, 10
Hawkesbury District Agricultural Association ...	C. S. Guest ...	„ 10, 11, 12
Coonamble P. and A. Association	J. M. Rees ...	„ 15, 16, 17
Durham A. and H. Association, Dungog, postponed until	C. E. Grant ...	„ 16, 17
The Central Australian P. and A. Association, Bourke	G. W. Tull ...	June 6, 7
Hay P. and A. Association	G. S. Camden ...	July 26, 27
National A. and I. Association of Queensland ...	....	Aug. 7 to 11
Murrumbidgee P. and A. Association (Wagga) ...	A. F. D. White ...	„ 22, 23
Cootamundra A., P., and H. Association	T. Williams ...	„ 28, 29
Gunnedah Show	J. H. King ...	„ 28, 29, 30
Northern Agriculture Association (Singleton) ...	C. Poppenhagen...	„ 29, 30, 31
Yass P. and A. Society	W. Thomson ...	Sept. 4, 5
Junee P., A., and I. Association	T. C. Humphrys...	„ 5, 6
Grenfell P., A., and H. Association	Geo. Cousins ...	„ 6, 7
Albury and Border P., A., and H. Society	W. J. Johnson ...	„ 11, 12, 13
Young P. and A. Association	Geo. S. Whiteman	„ 12, 13
Temora P., A., H., and I.	W. H. Tubman ...	„ 25, 26

1907.

Albion Park A., H., and I. Society	H. Fryer	Jan. 16, 17

[Two Plates.]

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Obituary.

Mr. WILLIAM FARRER.

It is with deep regret that we record the death of Mr. William Farrer, Wheat Experimentalist to the Department of Agriculture.

The late Mr. Farrer joined the Department of Agriculture as Wheat Experimentalist in September, 1898; previous to this, Mr. Farrer had for many years carried on experiments privately with wheat at his estate, Lambrigg, near Queanbeyan.

Mr. Farrer, as the result of his careful researches in connection with wheat, in its relation to its gluten content, drought, and disease resistant qualities, had a world wide reputation as a scientific investigator and a patient and thorough experimentalist, chiefly with a view to the making of wheats for Australian conditions.

Mr. Farrer was born 3rd April, 1845, and was thus 61 years of age at the time of his death, from heart disease, on 17th April.

VOL. XVII. PART 5. MAY 2, 1906.

Agricultural Gazette of New South Wales.

Effect of Formalin and Bluestone on the Germination of Seed Wheat.

D. McALPINE,
Government Pathologist, Victoria.

THE pickling of seed wheat for the prevention of stinking smut or bunt has now become an established practice, and the two substances most commonly used for this purpose are bluestone or sulphate of copper and formalin. Both methods have been found effective as far as the smut is concerned, but widely different opinions prevail among farmers as to their relative effects upon the grain, both as regards germination and the subsequent growth of the plant.

In treating seed wheat for smut, the idea is to apply some substance which will kill the spores of the fungus or prevent their germination, and at the same time leave the grain unaffected as far as its germinating power is concerned. From the vegetable nature of the spore, whatever is injurious to it may also affect the grain, hence the choice of substances is limited, and that which is most fatal to the spore and still harmless to the germ of the seed will be the best to use, other things being equal.

Extensive areas were sown during the past season, in which both the formalin and bluestone methods of treatment were employed, and the varying and often contradictory results obtained under different conditions of soil and climate naturally caused farmers who had suffered severely in the partial or entire failure of their seed wheat to germinate, to discuss the question and to ask for an explanation.

The widespread interest thus created in the question found expression both in the columns of the daily and country Press and even in Parliament, and the main object of this article will be to throw some light upon the causes of failure as far as carefully-conducted field experiments can, so as to prevent such losses in the future. For a number of years past I have given attention to this subject, and have conducted numerous experiments in the field to test the relative merits of formalin and bluestone, and before giving the results of a recent extensive series of experiments undertaken to determine with certainty the factors which influence the germination of formalin and bluestone treated grain, it will prepare the way for a clear understanding of these to give a brief summary of my previous experiments.

It is hardly necessary to mention that one must carefully distinguish between the effects produced upon the grain by formalin or bluestone and those which are dependent on the nature of the season, for when seed is sown in dry weather and the expected rain does not come for some time, it might equally fail to germinate owing to these natural causes, even when untreated. In some instances the seed has remained in the ground for three or four

weeks before sufficient rain fell to ensure germination, and in others the seed has been pickled for sowing, but circumstances arose which prevented its being placed in the ground for some time. In either case the farmer wishes to know how the treated seed fares as compared with the untreated, and it is only by sowing the two alongside of each other, under similar conditions, that the desired information can be gained.

Experiments with Formalin prior to 1905.

Pickling with bluestone solution for the prevention of smut has been known and practised for a considerable time, and is the method best known to farmers. But there were certain drawbacks in connection with its use which often gave rise to loud complaints. Its corrosive action on the grain, even after lime-water had been used, and its consequent interference with germination were frequently mentioned, although this was sometimes regarded as rather beneficial than otherwise since it eliminated all the weak and cracked grains likely to produce poor plants, if any, under ordinary conditions, and so led to the survival of the fittest and the best. Still there was a general feeling that some other effective treatment might be adopted without these drawbacks, and this led to a number of different steeps being experimented with, including the hot-water treatment of the seed.

As early as 1899 a trial on a small scale was made with formalin, and since it was found to prevent the smut as well as bluestone, these experiments were continued in succeeding years, gradually increasing the area under trial. In 1903 bulk field tests were carried out, up to 20 acres being treated, using both bluestone at the rate of 1 lb. to 5 gallons of water, and formalin at a strength of 1 lb. in 40 gallons of water, in both cases the seed being sown with a drill. The results are recorded in the *Agricultural Journal* of Victoria for March, 1904, and it is there stated, "The result of the treatment was very conclusive. While the untreated plot contained at least 50 per cent. of smut, careful search over the treated plots failed to reveal a single smutty head. Thus both solutions were equally successful in destroying the smut, but it was noticeable that the plot treated with formalin looked much better and was a little further advanced." Thus after trials extending over five successive seasons, I considered myself justified in recommending the treatment to farmers, and Leaflet No. 1 was issued in March, 1904, and reprinted March, 1905, giving the results of treating seed wheat with formalin at a strength of 1 lb. in 40 gallons of water.

Nature and Properties of Formalin.

Formalin, or formol, is the name given to a solution in water of a colourless pungent gas known as formaldehyde, and the solution ordinarily used contains 36 to 40 per cent. of the gas. Formaldehyde is obtainable from wood, alcohol, and other substances, and in solution has been extensively used in recent years as a germicide, as a hardening agent in animal and vegetable preparations, and as a general preservative. It is well known as a preservative for milk and other articles of food, and in a recent text-book of Legal Medicine

and Toxicology by Peterson and Haines (1904), it is stated that, "There are few, if any, preservatives that are less injurious than formalin, and circumstances may arise when it would be better to use formalin as a preservative than to run the risk of using milk that is undergoing decomposition." In the year 1888, a German scientist named Loew discovered the important fact that this gas possessed the property in a very high degree of destroying the spores of fungi, and this suggested its use in the treatment of such diseases as grain smuts. Hitherto a solution of the gas has been principally used for this purpose, but at South Dakota Agricultural College the gas itself has been tried, as recorded in *Bulletin* 89, November, 1904, "Preliminary Experiments with Vapor Treatment for the Prevention of the Stinking Smut of Wheat." The gas was found to be effective in destroying the smut; but further experiments are required, with specially constructed machines, before this method can be brought into general use and the liquid treatment superseded. A question has been raised as to the poisonous properties of this solution when the treated grain is eaten by stock, but it has been found that no injurious effects are produced by the strengths recommended. A farmer in South Australia gave one of his horses—by mistake—some barley that had been dipped in a strong solution of formalin, and no injury resulted. And in *Bulletin* No. 111 (1904) of the Wisconsin Agricultural Experiment Station it is further stated that "the formaldehyde solution used at the strength here recommended (1 in 36) is not poisonous, and will not injure the hands or clothing coming in contact with it. Oats that have been treated can be fed to horses, when mixed with a like quantity of oats that have not been treated, without detrimental results." The solution exercises a hardening effect on the coat of the grain, and this seems to reach its maximum on the third or fourth day after treatment.

In all the experiments recorded here, Schering's formalin has been used since it was necessary to have a definite standard throughout in order that the results might be comparable. What has been well named "fraudulent formalin" has been placed upon the market. The farmers of Nhill purchased a so-called formalin in good faith; but when the harvest came round, the quantity of smut in their wheat aroused their suspicions; and on having samples analysed, they were found to contain only a little over 2 per cent. of formaldehyde.

Field Tests in 1905.

In order to answer certain questions that were raised in connection with the formalin treatment of the seed, a series of field tests was undertaken, and not only were large plots sown in certain cases with treated seed, but a definite number of grains was sown in smaller plots, and the resulting plants counted. A piece of land was chosen at Port Fairy, consisting of black volcanic sand. It was freshly prepared, and generally equal throughout. In each small plot 1,000 grains were sown, in rows of 100 each, with 9 inches between each row, and 6 inches between each seed. It was thus possible to fairly test the effect on germination of various treatments, and at the same time get a definite reply in the number of plants that grew.

Effect of Formalin Treatment on different varieties of Wheat.

There is an opinion among farmers that the strength of the solution ought to vary with the different kinds of wheat, as the so-called soft wheats are likely to absorb more of the solution than the others. It would be interesting to learn whether different varieties of wheat differ in their ability to withstand treatment by fungicides, and so four different varieties were chosen, treated exactly alike with formalin, and sown on the same day. A farmer has distinctly stated that Marshall's No. 3, for instance, should be treated with a much weaker solution than Purple Straw or Dart's Imperial, so these three wheats were among those tested.

TABLE I.—Different Varieties of Wheat—Formalin treated and untreated.

	Grade.	Dart's Imperial.	Purple Straw.	Marshall's No. 3.
	Per cent.	Per cent.	Per cent.	Per cent.
Untreated	78	75	84	83
1 lb. in 40 gallons	66	68	77	81
Killed by treatment	15	12	8	2½ (nearly)

The absolute germination varied as might be expected, but it would appear that wheat with a high germinating power suffered less from the effects of formalin than wheat with a low germinating capacity.

Final conclusions cannot be drawn from such a small number of varieties tested in one season, but the proportion of seed destroyed by treatment is certainly greater in some varieties than in others.

The plots were examined, and the plants counted about nine weeks after sowing, and the untreated looked slightly better than the treated, but the difference was not marked.

Effect of varying strengths of Formalin on Germination.

Purple Straw was the variety generally chosen for testing, as it is a wheat very largely grown in Victoria. It has been already pointed out that as the result of several years' experiments, 1 lb. of formalin in 40 gallons of water was found to be safe and effective when the grain was sown within a day or two of treatment. This was the strength ultimately used and recommended by myself, but there were others who favoured a stronger solution, and so varying strengths of 1, 2, and 3 lb. in 40 gallons of water were tried. All the plots were sown together the next day after treatment.

TABLE II.—Varying strengths of Formalin used.

Untreated	84 per cent. germinated.
Formalin, 1 lb. in 40 gallons	77 ,, ,,
,, 2 lb. in 40 ,, ...	62 ,, ,,
,, 3 lb. in 40 ,, ...	41 ,, ,,

This test showed that 1 lb. in 40 gallons was much less injurious to germination than any of the others, and while 3 lb. in 40 gallons produced small plants in addition to poor germination, the other two treated plots were much about the same, as far as the plants themselves were concerned. In

another experiment, conducted about a month earlier, and which is given below in its proper connection, seed-wheat of the same variety, treated with formalin, 2 lb. in 40 gallons, yielded much better results. While the check-plot showed 88 per cent. of germination, the formalin treated plot gave 72 per cent., so that relatively there is much less difference in germination between treatment with 1 and 2 lb. of formalin in 40 gallons than there is between treatment with 2 and 3 lb. in 40 gallons.

Effect of Formalin and Bluestone treatment compared.

A special test was made with Purple Straw wheat to compare the effect on germination of the ordinary bluestone treatment of the seed, 1 lb. to 5 gallons, with the ordinary formalin treatment, 1 lb. to 40 gallons, and the following was the result:—

TABLE III.—Formalin and Bluestone treatment compared.

Untreated	884 germinated per 1,000.		
Formalin, 1 lb. in 40 gallons...	740	,,	,,
Bluestone, 1 lb. in 5 gallons	606	,,	,,

Not only did the bluestone treatment affect the germination much more injuriously than the formalin, but the plants did not look as healthy as the others. These plots were examined seven weeks after sowing.

In all the preceding experiments the grain was sown within a day or two of treatment, but it is now well known that after certain strength of formalin treatment, if the grain is kept for some days and allowed to become bone-dry before sowing, germination is seriously impaired. I laid special stress on this fact, when it was proposed by the Director of Agriculture, Victoria, to send out seed-wheat treated with formalin (2 lb. in 40 gallons) to the leading agricultural societies, and it is simply because of this recommendation that the following experiments mainly deal with this strength. In the case of bluestone there is a fine film of the substance left on the seed after treatment, and this will likely have a preservative and protective effect upon the grain.

Varying times of Sowing after Treatment.

The strength of formalin used was that recommended by the Director of Agriculture, viz., 2 in 40, and large plots of a quarter-acre, and smaller plots containing 1,000 grains of Purple Straw wheat were sown, with the results shown in the following table:—

TABLE IV.—Formalin, 2 lb. in 40 gallons—varying times of sowing after treatment.

(1,000 *grains—15 lb. on ¼-acre plots.*)

Untreated	88 per cent.	Germination	—superior.
Treated and sown next day..	72 ,,	,,	—nearly as good as untreated.
38 days after treatment ...	2 ,,	,,	—very thin and poor.

The plots were examined about fifteen weeks after sowing, and in those containing 1,000 grains, the untreated plots looked well and healthy, while that treated and sown next day was not so advanced. But where the seed was treated and kept in the bags for over five weeks before sowing, the result was a failure. The rows were quite indistinguishable, and only a stray grain here and there germinated.

The quarter-acre plots, generally, agreed with the smaller plots, and showed decidedly the injurious effect on the germination of holding over seed-wheat treated with formalin 2 lb. in 40 gallons. The plants were not only very scattered, but had a very unhealthy appearance.

No tests were made this season in the field, as regards the effect of germination of bluestone-treated seed-wheat when kept for some time before sowing, since the point at issue was in connection with formalin-treated seed.

Mixing Treated Seed Wheat with Manure before sowing.

It was brought under my notice that some farmers added superphosphate to their formalin-treated seed-wheat, with the result that it did not germinate, so I carried out an experiment to test the matter. Purple Straw was treated with formalin, 2 lb. in 40 gallons, and, while still damp, the seed was mixed with Florida superphosphate, equal to a rate of 50 lb. per acre, and left overnight. Two rows of this were sown next day, and alongside wheat simply treated with formalin, and without manure. When examined later, only a few plants appeared in the first plot, and it was, practically, a failure, while the plot without manure germinated fairly well. No doubt the addition of manure in this way injuriously affects germination, and I find that in South Australia, when seed-wheat was mixed with superphosphate, after pickling with bluestone, and sown in a damp condition, it failed to germinate. Professor Angus, in referring to this in the *South Australian Journal of Agriculture* for October, 1905, p. 233, remarks:—"Cannot say this matter has ever before been raised. It is held by some chemists, that while there is any quantity of free sulphuric acid present in the superphosphate, it may have a harmful effect on the germination." I submitted the matter to Mr. Guthrie, Chemist to the New South Wales Department of Agriculture, and he considers that no prejudicial effect is likely to follow the use of a mixture of superphosphate and formalin, or copper sulphate, but the presence of free acid in superphosphate is likely to injure the germinating of wheat if the grain is in contact with manure.

The method adopted by Mr. S. Salter, a Wimmera farmer, of pickling with manure added, certainly shows that with only a small quantity of manure, as he recommended, there is no danger to the grain. His directions are:—"Take one bag of grain and put it in a trough, then take 4½ gallons of cold water, and add to this water ¼ lb. of bluestone pounded to a powder, thus making a liquid pickle; then take this liquid and throw it over the seed grain in the trough, turning it over a few times as quickly as possible with a spade, so as to prevent the liquid from escaping. The next thing is to take the manure (14 lb. to ¾ bushel of seed—the quantity I sow per acre—or about 56 lb. to the bag of seed grain) and mix it thoroughly through the moistened or damp grain with the spade, as before, until all the grain becomes coated. The grain is now bagged while moist, taken away to the paddock, and sown by hand broadcast while in the moist state." The well-known success of this method of coating the grain with manure, and pickling at the same time, shows that the two in combination are not antagonistic to germination; but the weak solution of bluestone and the small amount of

manure used, together with the rapid sowing, may have something to do with the favourable result. It is also shown subsequently that a farmer to whom some formalin-treated grain was sent, mixed it with manure immediately before sowing, at the rate of 70 lb. to the acre, and yet it germinated well. The trouble seems to arise from keeping overnight the wet seed to which manure has been added.

Summary of Results of Field Tests.

These experiments were designed to answer various questions which the farmer naturally asks about the use of formalin, and the planting of 1,000 grain plots enabled a definite answer to be given, having due regard to the conditions under which the experiments were made.

What is the best strength of formalin to use? How does it compare with bluestone as far as germination is concerned? What effect is produced when treated seed-wheat is kept for some time before sowing? And do different varieties behave differently under treatment? The answers, as supplied by these experiments, are: 1st. That the best strength of formalin is 1 lb. in 40 gallons of water; 2nd. That it is less injurious to germination than bluestone, when seed is sown within a day or two after treatment; 3rd. That when seed is treated with formalin, 2 lb. in 40 gallons, and kept for some time before sowing, germination is injuriously affected; and 4th. That the better the normal germination of the variety, the higher will be the percentage after treatment.

Pot Tests.

In the absence of a completely equipped experiment station, the field experiments are necessarily limited in their scope; but by means of germination tests in pots, and even on damp blotting-paper, or in a seed-germinator, a greater variety can be carried out. It will be interesting to note how far these latter agree with or differ from tests made in the field, and how far they can be relied upon as practical guides to the farmer. In the pots, the soil was carefully and frequently watered, and to this extent the conditions would be more favourable than in the field. Besides, the watering would tend to dilute the bluestone surrounding the grain, and to keep the formalin-treated seed soft, so that germination will be rendered easier, and the results approach more nearly to that of the untreated grain. The following table, comparing tests which were carried out in the field as well as in the pots, shows the relation between the two, the treated grain being sown immediately after treatment.

TABLE V.—Field and Pot Tests compared.

	Pot. Per cent. germination.	Field. Per cent. germination.
Purple Straw wheat—		
Untreated	93-95	84-88
Formalin—		
1 lb. in 40 gallons	86-89 (warm situation)	74-77
,, ,, ...	70 (cold, sunless position)	—
2 lb. in 40 gallons	82 (warm situation)	62
,, ,, ...	46 (cold, sunless position)	—
3 lb. in 40 gallons	55 (warm situation)	41
,, ,, ...	18 (cold situation)	—
Bluestone, 1 lb. in 5 gallons...	81	61

A number of tests, however, were made in the pots, which had not been carried out in the field, particularly as to the effect of germination of keeping grain treated with formalin, 1 lb. in 40 gallons, for varying periods before sowing. The results are given in the following tables:—

TABLE VI.—Effect of keeping treated grain before sowing.

	Date Sown.	Number germinated in days.							
		6	7	8	9	10	11	14	23
Check	22nd August, 1905.	26	54	80	91	92	92	92	95
Formalin—									
1 lb. in 40 gal., sown damp, just after treatment.		34	62	79	89	92	92	93	*
1 lb. in 40 gal., sown 24 hours after treatment.		10	19	29	59	74	75	75	86
1 lb. in 40 gal., sown 4 days after treatment.		0	3	10	31	49	59	71	77
1 lb. in 40 gal., sown 18 days after treatment.		3	10	35	60	77	78	80	85
1 lb. in 40 gal, sown 26 days after treatment.		11	33	46	65	75	78	84	86
2 lb. in 40 gal., sown 24 hours after treatment.		9	16	33	48	64	64	70	82
2 lb. in 40 gal., sown 18 days after treatment.		0	4	8	16	24	25	26	37
3 lb. in 40 gal., sown 24 hours after treatment.		2	7	20	28	35	36	45	55
Bluestone—									
1 lb. in. 5 gal., sown 24 hours after treatment.		26	34	40	49	61	67	75	81
1 lb. in 5 gal., sown 15 days after treatment.		10	20	27	43	72	74	81	91

* Figures not available—pot disturbed.

TABLE VII.—Additional Tests.

	Date Sown	Number germinated in days							
		7	8	9	10	11	13	14	23
	1905.								
Check	16 Aug.	...	28	...	87	87	89	93	93
Formalin—									
1 lb. in 40 gal., sown wet, just after treatment.	18 ,,	1	18	...	73	78	83	88	93
1 lb. in 40 gal., sown wet, 24 hours after treatment.	19 ,,	2	...	42	47	51	74	...	89
1 lb. in 40 gal., sown wet, 14 days after treatment.	18 ,,	0	13	...	57	66	70	73	79
1 lb. in 40 gal, sown wet, 14 days after treatment. (Soaked 24 hours in water before sowing.)	19 ,,	1	...	61	73	80	84	...	92
Bluestone—									
1 lb. in 5 gal., sown 9 days after treatment.	16 ,,	...	...	12	40	...	77	82	91

Varying strengths of Formalin used, and varying periods of Sowing after Treatment.

This is, perhaps, the most important point, from the farmer's point of view, that requires to be determined in connection with the use of formalin; for it is generally agreed that a strength of 1 lb. in 40 gallons of water is safe to use, when sown within about two or three days after treatment, in soil that is sufficiently moist to ensure germination. But in our dry, northern districts, where the grain may be sown in anticipation of rain which does not come immediately, then it becomes a question, how does the formalin of various strengths affect the grain under such conditions, and how does it compare with untreated and bluestone-treated seed? If a long, dry spell ensues after sowing, then it may be a case of re-sowing, whether treated or untreated; but if the conditions are such that untreated grain would germinate, the question is, how does the treated grain compare with the untreated?

It has already been shown in the field-tests that, when grain was treated with formalin—2 lb. in 40 gallons, and kept for about five weeks before sowing—it was practically a failure; but, in order to test the results for intermediate periods and different strengths, pot tests have been made. Since 1 lb. in 40 gallons is the strength I have recommended, its effect on germination was specially tested. Grain thus treated was sown at once, and at periods varying from one to twenty-six days after treatment. The number of grains germinated were recorded from the sixth to the twenty-third day, and this will show what effect the different treatments had in retarding or hastening germination.

If a general view be taken of the results, as recorded in Tables VI and VII, it will be seen that, if sown a day after treatment, there is comparatively little difference between the strength of 1 lb. in 40 gallons and 2 lb. in 40 gallons as regards germination; but if kept for some time—say, two or three weeks—then there is a striking difference; for the former treatment may yield not less than 80 per cent. of germination, while the latter may give as low as 37 per cent.

When 3 lb. in 40 gallons is used, then little more than half the grain germinates, even if kept for only one day before sowing. The germination tests thus show that keeping grain treated with formalin, 1 lb. in 40 gallons, for about four weeks at least, does not impair the germination more than if kept for one day.

The details of germination are very instructive. When formalin-treated grain, 1 lb. in 40 gallons, is sown damp, just after treatment, the germination approaches closely to the untreated. When kept for one day, the germination is slower, and the total percentage not so good. If kept four days before sowing, the germination is much slower, and the total less. If, however, the treated grain is not sown for fourteen days, the germination improves again, till after about four weeks it is practically as good as that sown twenty-four hours after treatment. As the grain in these pot-experiments was treated

in small lots of 100 grains each, they rapidly became dry after treatment, being perfectly dry and hard the next day. In tests where a bushel or more of seed is treated, the grain is quite soft for several days; hence tests from bulk-treated seed might be expected to give better results, if sown twenty-four hours after treatment, than were obtained with these small lots; and the worst results might be obtained from such seed sown about a week after treatment, an improvement commencing, perhaps, after three weeks. In grain treated with formalin, 2 lb. in 40 gallons, and kept for some time, the germination was excessively slow, and the percentage very poor.

Bluestone Treatment.

Treatment with bluestone, at the rate of 1 lb. in 5 gallons, compares very favourably with the formalin treatment, and, when kept for nine and fifteen days respectively before sowing, instead of deteriorating, the grain actually germinated better. When sown after being kept for one day, the germination is equal to that of the untreated at first, but, after the sixth day, it germinates more slowly. When kept for about a fortnight, the germination at first is much slower than that of the recently treated, but it soon surpasses it. If germination is compared with that of the formalin-treated grain, when both have been kept for one day before sowing, the bluestone treatment has the advantage for the first week or so, but afterwards, the formalin-treated gains upon it. In the field-test, the formalin-treated seed-wheat gave the best germination, when the plots were examined seven weeks after sowing.

Moist Flannel or Blotting-paper Tests.

The pot-tests have shown that when seed treated with formalin, 1 lb. in 40 gallons, is sown in a damp condition just after treatment, the results are practically equal to those obtained from untreated seed; and when damp blotting-paper or moist flannel is used, the conditions are very much the same.

As the Director of Agriculture requested me to germinate some wheat treated with different strengths of formalin, I selected Rerraf; and lots of 1,000 grains were submitted to formalin solution, varying in strength from 1 to 3 lb. in 40 gallons of water. Such small quantities of seed soon became dry, and, half-an-hour after treatment, they were placed in moist flannel for germination, along with 1,000 grains left untreated. The date was 14th March, and, as the weather was comparatively warm, the germination was rapid. The first two days really showed the relative germinating capacity of the grains as they were affected by their respective treatments. In the untreated lot 830 germinated, closely followed by that treated with formalin—1 lb. in 40 gallons—or with a germination of 827. The lot treated with 2 lb. in 40 gallons reached 714, and 3 lb. in 40 gallons only yielded 480.

In the report submitted with these results, I concluded with the remark that, during the coming season, lots of 1,000 grains of wheat, treated the same as above, will be sown in the field, and the results of germination compared.

Accordingly, on 28th July, in the middle of winter, this was done, only Purple Straw being used instead of Rerraf. Making due allowance for the difference of temperature, it will be seen that the number germinating in two days in moist flannel closely agrees with actual results in the field.

TABLE VIII.—Sown in Field and Flannel compared—the latter half-an-hour after treatment.

	Date of Flannel Test.	Number germinated in days—					In Field—sown 28th July.
		2	3	5	6	9	
	1905.						
Check	14 Mar.	83	91	94	94	96	84
Formalin—							
1 lb. in 40 gal. ...	14 ,,	82	90	94	94	96	77
2 lb. in 40 gal. ...	14 ,,	71	86	93	94	96	62
3 lb. in 40 gal. ...	14 ,,	48	63	74	77	78	41

When sown on damp blotting-paper or in a seed germinator the grain is in a most favourable position for germination, and these ideal conditions are not realised in actual practice: but the value of such tests consists in this, that they show, relatively to the untreated seed, how many have actually been injured or destroyed by any course of treatment.

The results obtained with bluestone under these conditions have no bearing upon the germinating capacity of seed sown in soil, since, in the latter case, the bluestone is largely removed from proximity to the germinating grain, while in the blotting-paper or flannel tests it remains in solution around the grain. And, as regards formalin-treated seed kept constantly moist, after the first two or three days the hardening effect is prevented or neutralized, and germination is practically the same as if the grain was untreated.

Soil tests are of course necessary in determining the germination of seed that has been treated for the prevention of smut, but as far as formalin is concerned the percentage germinating in between two and three days in moist blotting-paper agrees fairly closely with that obtainable in pot and field.

A general comparison of results obtained in the field, in pots, and in blotting-paper shows substantial agreement in nearly all cases, taking the number germinating in blotting-paper between two and three days as a standard, though the pot tests, as a rule, give better results than the field. In regard to bluestone, the field tests show much less satisfactory results than those in the pots; perhaps in the latter case the constant watering tended to remove the bluestone more rapidly from proximity to the germinating grain.

TABLE IX.—Blotting-paper, Pot, and Field Tests compared.

Purple Straw Wheat.	Blotting-paper. Number germinated in days— 2	3	4	Pot. Total Plants.	Field. Total Plants.
Check	82–98	91–98	91–98	93–95	84–88
Formalin—					
1 lb. in 40 gal., sown damp	82	90	94	88–93	...
1 lb. in 40 gal., sown 24 hours after...	73–77	84–96	96–98	70–89	74–77
1 lb. in 40 gal., sown 4 days after ...	26	47	75	77*	...
1 lb. in 40 gal., sown 18 days after ..	65	69	90	85	...
1 lb. in 40 gal., sown 26 days after ...	88	96	98	86	...
2 lb. in 40 gal , sown damp	71	86	93	...	...
2 lb. in 40 gal., sown 24 hours after..	37	79	81	82–89	62–72
2 lb. in 40 gal., sown 18 days after ..	...	...	...	37	...
2 lb. in 40 gal., sown 29 days after ..	0	5	29	...	..
2 lb. in 40 gal., sown 38 days after ..	...	...	...	...	2
2 lb. in 40 gal., sown 67 days after ...	0	0	13	...	...
3 lb. in 40 gal., sown damp	48	63	74†	...	...
3 lb. in 40 gal., sown 24 hours after .	4	39	57†	18–55	41
Bluestone—					
1 lb. to 5 gal., sown damp	...	.	...	92	...
1 lb. to 5 gal., sown 24 hours after ..	...	...	. .	81–90	61
1 lb. to 5 gal., sown 9 days after ...	..	...	. .	91	...

* As seen from Table VI, germination of this lot very slow. † Some of these abnormal, no rootlets being pushed forth, only the young stalk burst through

Pot Tests and Blotting-paper Tests compared.—A number of comparative tests were made of seed treated with formalin of various strengths and bluestone, part of the seed being sown in pots, and part placed in moist blotting-paper, 24 hours after treatment. It will be seen that so far as the formalin-treated seed and the check lots are concerned, there is a general agreement between the results, taking the seed germinating in blotting-paper at between two to three days as a standard. As elsewhere stated the blotting-paper tests for bluestone-treated wheat are valueless, since the poison remains in solution close to the grain instead of being either neutralized or carried away and diffused in the surrounding moisture, as it would be in the pot or field tests.

TABLE X.—First Test.

	Date Sown.	Number germinated in days. Pots. 10	12	14	19	23	Blotting-paper. 2	3
Check	1905. 5 Aug	45	84	90	93	94	97	98
Formalin—								
1 lb. in 40 gal.	5 ,,	8	27	35	54	70	77	96
2 lb. in 40 gal.	5 ,,	5	22	28	43	46	35	68
3 lb. in 40 gal.	5 ,,	1	9	13	18	18	1	15
Bluestone—								
1 lb. in 5 gal.	5 ,,	6	19	48	87	87	9	20
1 lb. in 5 gal.	9 ,,	...	19	58	86	90	24	40

The pots were placed in a cold sunless position, hence the seed was slow in germinating as compared with the succeeding series. The blotting-paper tests were carried out in the laboratory at room temperature, which was very low at the time.

TABLE XI.—Second Test.

	Date Sown.	Number germinated in days.						
		Pots.					Blotting paper.	
		6	8	10	14	23	2	3
	1905.							
Check	22 Aug.	26	80	92	92	95	98	98
Formalin—								
1 lb. in 40 gal.	22 ,,	10	29	74	75	86	73	84
2 lb. in 40 gal.	22 ,,	9	33	64	70	82	37	79
3 lb. in 40 gal.	22 ,,	2	20	35	45	55	4	39
Bluestone—								
1 lb. to 5 gal.	22 ,,	26	40	61	75	81	11	25

Pots placed in a warm sunny position. Blotting-paper tests in laboratory at room temperature.

Soaking Formalin-treated Seed in water before Sowing.

An interesting experiment was carried out by Mr. R. Cramer, of Myers Flat, which proves conclusively that seed-wheat treated with formalin does not lose its capacity for germination, even when it is kept after treatment for 54 days. Formalin, as is well known, has a hardening effect, and if the seed is kept after treatment sufficiently long to become bone dry, then the skin of the grain is so hard that the living germ inside is unable to pierce through, and so it does not germinate, but if the grain is soaked in water before sowing, sufficiently long to soften the skin, then the normal germination occurs. Fifteen pounds of the seed-wheat sent out to farmers by the Department, after treatment with formalin, was despatched on 3rd May to Mr. Cramer, but owing to some misunderstanding, it was not received by him until 20th June. He then steeped the grain for 24 hours in water, using separate vessels for the 15 lb. untreated, and the 15 lb. treated with formalin, so that the two lots were sown under exactly similar conditions. The grain was then spread out on a large tin square kept for the purpose and manure—superphosphate and bone-dust mixed—sprinkled over it at the rate of 75 lb. to the acre, shovelling it over and mixing it well. Without allowing it to dry it was broadcasted at once, and the result is that the treated and untreated wheats growing side by side are doing well, and both have germinated successfully. The variety of wheat sent was Outpost, and it was treated on 1st May, then spread out on the floor to dry sufficiently for being despatched by rail. In my pot experiments (See Table VII) I also tried the effect of soaking the seed for 24 hours in water before sowing, after being treated with formalin, 1 lb. in 40 gal., and kept for fourteen days. The result was that the germination was practically equal to that of the untreated, as at the end of 23 days, 93 per cent. in the check pot, and 92 per cent. in the treated pot had germinated.

Results of Experiments in other States.

New South Wales.

Mr. Farrer, Wheat Experimentalist of New South Wales, has devoted a considerable amount of attention to the subject of treating seed-wheat with formalin, and he has carried out a series of experiments in order to test the effect on germination of formalin and bluestone respectively. In the *Agricultural Gazette* of New South Wales for December, he has recorded the latest results obtained by him, and they indicate among other things, that—

"(1) Formalin does not exercise an injurious effect upon the vitality of seed grain if it be treated just prior to planting, and the conditions at planting time are favourable for its germination.

"(2) It is undesirable (and previous experiments at Lambrigg prove unnecessary) to treat seed-wheat with a stronger solution of formalin than that made by mixing 1 lb. of formalin with 40 gallons (400 lb.) of water."

South Australia.

A number of faremrs in South Australia have taken a lively interest in the pickling of seed-wheat with formalin and have carried out a number of tests, but they do not seem in all cases to be strictly comparative. Sufficient attention has not always been paid to the strength of solution used, and it is not always clear that the failure of the seed to germinate was the result of the formalin treatment.

In the October (1905) *Journal of Agriculture* for South Australia, p. 227, one farmer is reported to have "pickled some wheat in a solution of Schering's formalin at a strength of 1 lb. to 40 gallons of water, and sowed the seed within two or three days alongside seed treated with bluestone in the ordinary way. While the former germinated satisfactorily the latter came up quicker and had stronger growth. Some formalin-pickled seed, which was kept for 15 days before sowing did not germinate." As regards the formalin-pickled seed kept after treatment, my results were very different according as the strength was 1 lb. in 40 gallons or 2 lb. in 40 gallons. I found that 1,000 grains sown in the field and pickled with formalin of the strength of 2 lb. in 40 gallons, and kept for 39 days before sowing, practically failed to germinate, while the untreated plot alongside gave 88 per cent of germination. But in a pot test, grain treated with formalin, 1 lb. in 40 gallons, and kept for 14 days before sowing, germinated 79 per cent.; so that the strength of the formalin pickle has to be taken into account; in relation to its effect on germination. In addition, as stated in discussing the pot test, the question whether the seed sown was part of a bulk-treated sample, or only a small one, might have an important bearing on the result.

In the same journal for August 1905, at p. 60, a farmer stated "that wheat pickled with formalin and not sown for 16 days had germinated very badly, not more than 50 per cent. of the seed having come up. He thought seed pickled with formalin should be sown within a week of treatment. Here there is no indication of the strength or quality of formalin used, nor a comparison with unpickled grain. But in the May and October Journals of

this year, details of germination tests in summer and winter are given which, in the words of the editorial, "bear out the complaint that unless the wheat is sown very soon after pickling the grain is injured." An important qualification has to be made, however, according to the strength of the solution used. In the summer test of South Australia, in which the seed was sown on 21st February, the results are invariably given for the sixth day after sowing, but, this does not by any means represent the full germinating capacity of the formalin-treated seed. Formalin exercises a hardening effect on the grain, so that the young germ does not so readily force its way through the skin; hence the figures in my experiments which show the results on the sixth day after sowing are very different from those on the fourteenth or twenty-third day (See Table VI).

With regard to the winter test of South Australia in which the seed was sown on the 25th June, none of the solutions are as weak as 1 lb. in 40 gallons, so that comparisons cannot be made.

Results in the United States and Canada.

United States.

The formalin treatment for the prevention of smut is now extensively used in the United States, and while employed for wheat and barley smut it is principally the oat smut which receives attention there. This is probably owing to the fact that the prevention of oat smut has only recently been found practicable, whereas stinking smut of wheat has been satisfactorily treated for many years.

In the State of Wisconsin, it is stated in *Bulletin* No. 98 (1903), "that not less than 10,000 farmers treated their seed, grain (oats) in accordance with directions emanating from this Station, to prevent smut during the past season, and hundreds of reports at the office of the Experimental Station, show that in practically all cases the treatment was wholly effective or nearly so." The strength of formalin solution recommended was 1 lb. in 36* gallons of water.

As early as 1895, Professor Bolley carried out experiments with formalin for the prevention of smut, ultimately recommending a strength of 1 lb. in 50 gallons, and now its use is general throughout the States. The strengths used vary somewhat at the different Agricultural Experimental Stations, ranging from 1 lb. in 50 gallons to 1 lb. in 36 gallons, and in the case of barley 1 lb. in 20 gallons is sometimes recommended owing to the greater resistance of the husk.

Bolley has tested the influence of formalin and bluestone on germination, and the results are recorded in *Bulletin* No. 27 of the North Dakota Experimental Station (1897). At that date the proper strength to kill the smut spores without injuring the grain was not as well known as at present, and he experimented with solutions ranging from 1 lb. in 300 gallons to 1 lb. in

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* [The United States standard gallon is less than the Imperial gallon; the former contains 231 cubic inches, while the latter contains 277·274 cubic inches, or 1 Imperial gallon is equal to 1¼ United States gallons nearly.]

50 gallons. As the latter strength comes nearest to that used by us, the figures relating to it will only be quoted. Bluestone was used at the rate of 1 lb. to 4 gallons and is sufficiently near to 1 lb. in 5 gallons for comparison.

Method of Treatment.	Pickle used, and strength.	Pickled previous to Sowing.	Per cent. of Germination.	Strength of Growth.
Sprayed	Formalin, 1 in 50 ...	20 days ..	98	Medium.
Do	do ...	9 months ..	85	do
Untreated	....	....	100	Normal.
Dipped 3 minutes ...	Bluestone, 1 in 4 ...	5 day ...	70	Weak.
		9 months ...	56	do
Untreated	....	....	95	Normal.

While the bluestone treatment entirely prevented the smut, the formalin treatment did not absolutely destroy it.

The latest method of treating grain with formalin is given by Professor Arthur in *Bulletin* No. 103 of the Purdue Agricultural Experimental Station (1905). "Rapid method of removing smut from seed oats." The formalin solution is applied in the form of a spray and the wet grain is allowed to lie in bulk for at least two hours, preferably longer, before being sown. Several elevators in the State of Indiana are fitted up to perform this operation at a very small cost.

Canada.

In Canada it would appear that the formalin treatment is also largely employed, for it is stated in the Experimental Farms' Report for 1903 that this well-known antiseptic, disinfectant, and preservative is now extensively and most satisfactorily used in Manitoba and the North-West Territories for the treatment of seed grain for smut.

In the Report for 1904 one experimenter recommends bluestone for smut in wheat and formalin for smut in oats and barley. He says:—"Bluestone, from cheapness, ease in application, and effectual cure, has proven the best for wheat, while formalin has given the best results for smut in oats and barley. While formalin is not more expensive than bluestone the application is more difficult, the seed having to be soaked longer."

At the Ontario Agricultural College, formalin was used at the rate of 1 pint in 42 gallons of water, and in referring to the results in the Report for 1903, it is stated that "the formalin treatment is easily performed, comparitively cheap, and very effectual.

Summary of Results in Victoria.

No account is taken here of the effect of the different treatments on the development of smut, since that has already been made the subject of special investigation. The tests were concerned with the effect on germination, and they apply to a cool coastal district such as Port Fairy.

In the coming season it is desirable to carry out a comparative series of experiments in a northern district where dry conditions prevail, and where the grain may not always find the conditions necessary for germination immediately when sown.

As far as these experiments go, they have shown :—

1. That the best strength of formalin to use is 1 lb. in 40 gallons of water, since that ensures a safe and satisfactory germination.
2. That this strength may be used for different varieties of wheat, and the higher the normal germination the better are the results with formalin.
3. When formalin and bluestone treatments are compared, the former is found to give the higher percentage of germination.
4. That in wheat treated with formalin—1 lb. in 40 gallons of water—the germination is best if sown while still damp from the treatment, and becomes less and less satisfactory if sown each succeeding day, until about a week after treatment, when it is at its lowest point. It improves again when sown about two weeks after treatment, and continues to improve, so that when sown four weeks after treatment it is practically as good as 24 hours after treatment.
5. On the other hand, the germination of wheat treated with 2 lb. in 40 gallons, as a general rule, becomes worse the longer it is kept before sowing, that sown five weeks after treatment being practically destroyed, though it appears to be improved sometimes, at least, by soaking 24 hours in water before sowing.

Domestic Insects : Cockroaches.

(*Blattidæ.*)

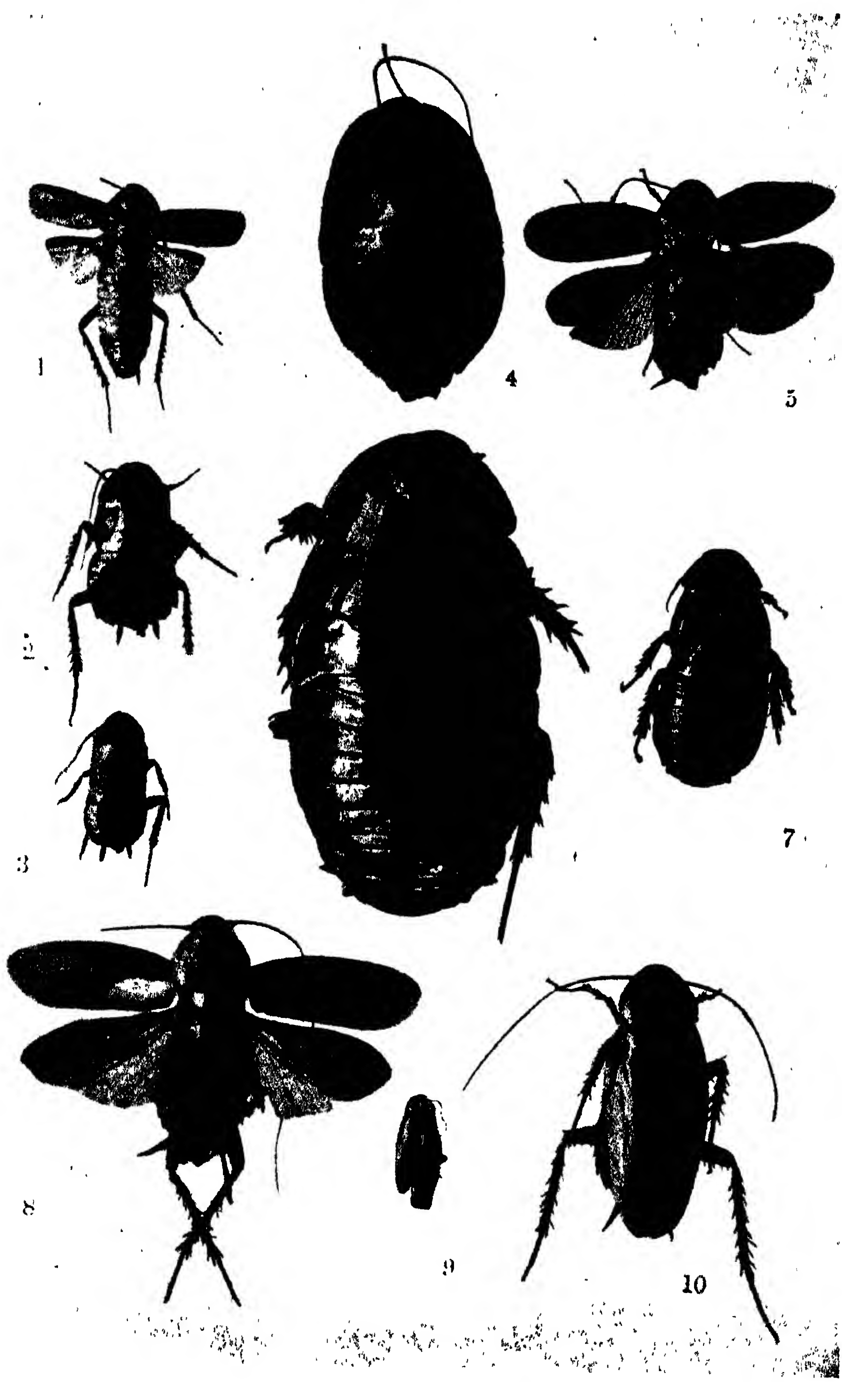
WALTER W. FROGGATT, F.L.S.,
Government Entomologist.

If we were to judge from their habits, cockroaches are very plebeian, for the domestic species live in cellars and underground rooms, where there is a certain amount of warmth, coming out at night to feed upon any exposed food,—poor relations of the kitchen and the pantry. Yet if we go back and look up the ancestry of the cockroach we find he can trace his descent from primeval ancestors who hunted through the forests of the Carboniferous Ages; and so persistent is the type that the fossil cockroaches of the Palæozoic rocks of North America, described by Scudder, differ very little in general from the insects of to-day. Therefore, in point of ancestry, he is quite a blue blooded aristocrat, even if he has given up the freedom and dangers of a forest life for the humdrum life of the kitchen. These insects have from a very early date been associated with the habitations of man, and are even found in the temporary shelters of the most primitive. When exploring on the Fly River, in New Guinea, the writer often examined the many bags of food and implements which the natives (acting on a system of true free-trade) stored away in their large canoes, and frequently found every bag containing thousands of brown cockroaches, often more cockroaches than anything else. (*Epilampra sp.*)

The cockroaches belong to the great order *Orthoptera*, which comprise grasshoppers, locusts, and crickets, and have the same kind of biting and chewing mouth of the vegetable feeders; but under altered conditions they are omnivorous in their tastes, and will eat almost anything, and are carnivorous or even cannibalistic when it comes to a case of hard times. A deep smooth earthenware jar, with some potato-peelings or other food, placed in a convenient place for the insect to drop into will often form a real death-trap, and, on examination a few weeks later, will show a mass of hard legs and wing-covers, the remains of the captives that have been devoured by their imprisoned comrades.

The insect collector will often find that cockroaches, particularly in the tropics, will play sad havoc with his dead specimens if left anywhere within their reach; but they cannot, I think, be called carnivorous insects in the true sense of the word,—though Tepper considers, from observations he made in South Australia, that they eat plant-eating ground larvæ.

While there are a few cosmopolitan cockroaches that by the agency of ships have spread all over the world and become domesticated both at home



DOMESTIC INSECTS: COCKROACHES.

and abroad, the majority are forest-hunting insects, living under logs and stones, or hiding under dead bark on the trunks of trees. They are most abundant in the warm, moist tropical countries; yet a species is said to occur at times in such quantities in the huts of the Laplanders as to damage large quantities of their stores of dried fish. It is stated on good authority that they cannot stand prolonged or excessive cold, and Hubbard records that in the severe winter of 1894, when the orange groves of Florida were greatly damaged, all the roaches, except a few in the more substantially built houses, were killed.

The typical cockroach is wonderfully adapted in form and structure for the life it leads: the whole body is enclosed in a stout, oval, flattened or convex case like the shell of a tortoise, but composed of many transverse plates fitting close together, those upon the back forming a more solid plate of thick chiton than those on the under surface. The head is furnished with long slender antennæ composed of an immense number of short annular segments, and two large eyes just projecting in front of the rounded shield of the front of the thorax, which is turned downward and hidden from above, while the stout spiny legs well adapted for running project on the sides. Those possessing wings, however, are usually more elongate in form; the stout, oval, flattened fore-wings or elytra, traversed with a network of simple but stout nervures, are laid flat over the flying fan-shaped hind wings which rest in a double fold on the back. The female has a very curious habit of producing her eggs in a horny capsule, which she often carries about with her for some days projecting from the tip of the abdomen, before she deposits it in some suitable crevice in the floor or wall in the house or attached to a twig, or under a log in the forest. The baby cockroaches are pale-coloured little creatures that undergo a number of moults, and, compared with other insects, take a long time to reach the adult state, when from the final moult emerges the perfect insect. Even in the warmer climates Marlatt considers that they only produce one generation in a year, and says, "The abundance of roaches is therefore apparently not accounted for so much by their rapidity of multiplication as by their unusual ability to preserve themselves from ordinary means of destruction, and by the scarcity of natural enemies." In Australia, the chief enemies of the cockroach are the parasitic wasps belonging to the family *Evaniidæ*, which deposit their eggs in the egg-capsules of the cockroach, the typical black *Evania princeps* being furnished with a short spine-like ovipositor admirably adapted for puncturing the leathery egg-case. This curious hatchet-bodied wasp in consequence is often found inside the house in Sydney resting on the window-frames, after it has emerged from the capsule in which it has been introduced into the house.

Besides the habit of the cockroaches in running over and devouring stored food, most species have a very objectionable roachy smell, which, when numerous, can be often detected on the food they have passed over. Several large wingless bush species in Australia have the glands containing this fœtid liquid very much developed, and, when disturbed, will stand with the tip of the abdomen turned up, and discharge the fluid which has such a vile

smell, that they seem to know they have no need to run away when armed with a regular Chinese stink-pot, which renders them quite safe from the attacks of predaceous insects or hungry birds.

Besides living in the house, cockroaches are very fond of the warm close atmosphere on shipboard, and though they are still numerous on ships at times, it was in the old days of wooden sailing ships that these insects had a good time, and the little tenders and river-boats along the northern coast of Queensland used to be alive with these pests. The old sailors' story about the cockroaches nibbling their toe-nails, so that they never required cutting, seems to be quite borne out by facts, while it reflects credit on the insect's digestive powers. A traveller in South America, Mr. Herbert H. Smith (quoted by Marlatt), says: "At Corumba, on the Upper Paraguay, I came across the cockroaches in a new role. In the house where we were staying there were nearly a dozen children, and every one of them had their eyelashes more or less eaten off by cockroaches, a large brown species, one of the commonest kinds throughout Brazil. The eyelashes were bitten off irregularly, in some places quite close to the lid. Like most Brazilians, these children had very long black eyelashes, and their appearance thus defaced was odd enough. The trouble was confined to the children, I suppose because they are heavy sleepers, and do not disturb the insects at work." Though, as a general rule, these insects have a great distaste to light, and rush off to hide the moment a light is struck, I have, in North Queensland, often seen the walls of country stores and publichouses so thickly covered with a small brown species (common all over the north) that at night time one could hardly put his finger upon the wall without touching one, and the dim light of the kerosene lamp did not appear to interfere with them in the least.

On the sugar plantations, in the rough wooden buildings known as the "bachelors' quarters," where the overseers lived, it was quite a common thing to see a row of large green tree-frogs sitting along the wall-plate, or a more friendly one sleeping on the washstand; they were encouraged by the men, who looked upon them as pets, from the fact that at night time they hunted all over the place catching and devouring the large brown cockroaches. In the Flinders River country a small Gecko lizard used to live in the walls of the men's hut, and hunt cockroaches upon the roof at night in a similar manner, but they were not so smart as the coastal tree-frogs.

Australia is rich in indigenous cockroaches, and in Kirby's "Synonymic Catalogue of Orthoptera," vol. I, 1904, published by the British Museum, 217 species are listed from Australia and Tasmania.

The Oriental Cockroach (Blatta Orientalis, *Linn.*).

Figs. 1 (Male); 2. Female; 3. Larva.

This is one of the oldest-known and first-described species of the cockroach family; for it was named by Linnæus as far back as 1758, and, though probably a native of Asia in the first place, it spread westward at a very early date, and has been the commonest domestic species in Central Europe and England for centuries. It is the common "black beetle" in London

houses; and in old or neglected houses, where suitable quarters and a certain amount of damp and warmth are obtainable, they multiply and swarm over everything; for it is a gregarious species in all stages of development, crowding together in their hiding-places during the daytime. The kitchen and store-rooms are their favourite quarters, but damp cellars are also more or less infested; and in the good old days of wooden sailing-vessels they swarmed all over the ship, and were one of the many discomforts that the traveller had to put up with unknown to modern ship life.

It is almost cosmopolitan in its range, and in early days was, if it is not now, common in Melbourne; but I do not think it is common in Sydney, and, according to Hudson, is rare in New Zealand.

It is of a uniform black or dark-mahogany colour, flattened on the dorsal surface, but broadly rounded to the tip of the abdomen, and measures when full-grown 1¼ inches in length. The male has comparatively short wings, not extending to the tip of the body, and the female is almost wingless. Tepper ("The Blattidæ of Australia and Polynesia," Trans. Royal Society of South Australia, 1892) says he has specimens of this species in the museum from Adelaide, Jamestown, Northern Territory, and Japan.

The Australian Cockroach (Periplaneta australasiæ, *Fabr.*).

Fig. 5.

This is said to have been our commonest house-cockroach in early times. It was described by Fabricius in 1775, and has since been described under a number of other titles. Walker alone gave it five different names, and placed them in two distinct genera.

As far as my experience goes, it is a rare species about Sydney now, though almost cosmopolitan in its distribution. Marlatt, in his "Household Insects" (Circular 51, Entomology. U. S. Department of Agriculture, 1892), says: "The Australian Roach resembles very closely the following species, but differs strikingly in the brighter and more definitely-limited yellow band on the prothorax, and in the yellow dash on the sides of the upper wings. In the United States it is the most abundant and troublesome species in Florida and some of the Southern States.

It measures under 1½ inches in length, and is of a general bright, reddish-brown tint, with the central portion of the dorsal surface of the thorax very dark, margined with pale yellow, and a broad stripe tapering to the middle of the wing of the same colour. When the wings are closed the tip of the abdomen is covered, and the general form is elongate oval.

This is a remarkable case of a species that is not a common pest to any extent in its own country becoming a very serious domestic pest when introduced into America.

The American Cockroach (Periplaneta americana, *Linn.*).

Figs. 8, 10.

Introduced from America many years ago, this insect has become the common house-cockroach in Sydney. When a resident of the kitchen and pantry, it hides during the day in dark corners, or among papers and

packages, coming out as soon as it is dark, but rushing away at the least glimmer of light when disturbed. Though they have such a dislike to light, they often come flying in through the open windows from outside to the lighted lamp, and go flying around the room before they make for shelter.

It is a large insect, measuring from 1¼ to 1¾ inches in length, with long, stout, spiny legs, and very long, slender antennæ, reaching beyond the tips of the closed wings. The wings are ample, extending past the tip of the abdomen. Its general colour is a regular reddish-brown, with the thorax yellowish and slightly mottled with brown.

This roach is very common in the middle and western States, where it is the only troublesome house species, and does a good deal of damage, where numerous, to books and other things in which paste is used. Marlett says that "One of the most serious cases of injury of this sort was reported by the Treasury Department. The backs, sometimes entirely, of both cloth and leather bound books were eaten off, to get at the starchy paste used in the binding."

It is probable that the advent of the larger and more formidable American roach into Australia has led to the retirement or destruction of our indigenous species; and this is a remarkable instance where, in modern times, one species has driven the other away, and taken possession of its quarters.

The German Cockroach (Phyllodromia germanica, *Linn.*).

Fig. 9.

This small cockroach is better known in catalogues under the old name of *Ectobia germanica*, and takes its specific name from the fact that it is very common in many parts of Germany as a house-pest. It is a small and very prolific species, and has been gradually spread all over the world by shipping. In the United States, where most insects are popularly called "bugs," this roach is known as the "Croton Bug," because it was first noticed in great numbers about the Croton waterworks, supplying New York city. Tepper says (in paper previously noticed) that its presence in Australia wants confirmation; but I have several specimens—caught in the Imperial Pensions Office, Circular Quay—that tally exactly with the figures and description. As the German mail-boats usually lie only a few hundred yards away from the office, it may be that they are recent importations.

This is one of the smallest domestic species, measuring under ¾ inch in length. Its general colour is light-brown, with a yellowish tint, marked on the thorax with two dark-brown stripes, forming a broad parallel line on either side.

This is a very serious pest, both in Germany, other parts of Central Europe, and the Eastern States of North America, and, from its small size, is able to get into much smaller holes and corners than the larger domestic species.

I find a later note by Tepper on this species (Trans. Royal Society, S.A., 1905), in which he says that he has received several specimens that were captured in the city of Adelaide, and agree perfectly with the descriptions.

The Botany Bay Cockroach (Polyzosteria limbata, *Burmeister*).

Fig. 4.

This is the common large cockroach found in the neighbourhood of Sydney, usually resting among the foliage or sunning itself on a fence or stump, seldom or never hiding under bark or logs like most of the species, and quite regardless of the light, so distasteful to the domestic species. It is probably so fearless of exposure from the fact that it has few enemies that would attempt to interfere with its rest, as it is endowed with glands at the apex of the abdomen, from which it discharges a quantity of fœtid matter which has such an offensive smell that it is a regular skunk of the insect world. When disturbed, it simply raises the tip of its abdomen and discharges this fluid, which is very effective protection against every enemy except the enthusiastic entomologist. There is another closely allied species found in the mallee scrubs on the ranges near Bendigo, Victoria, which, in our boyhood days, we used to annoy with a long stick, and try to persuade our dog to investigate, which was even more bellicose and offensive in his attitude, and, in consequence, was known to the boys under the very appropriate, if rather vulgar, name of the "stinker."

The Botany Bay cockroach is, like the other members of the group, a wingless insect, measuring up to 1½ inches in length and about an inch across the body. The upper surface is dark brown, with a faint bronzy tint in fresh specimens; the outer margins finely edged with yellow. The prevailing colour on the under surface is chocolate, or dull reddish brown, with the lower edges of the abdominal plates and legs marked with yellow. The whole of the upper surface is finely rugose, the punctures more defined towards the margins and apex.

This cockroach was first described by Burmeister, in his "Handbook of Entomology," published in 1838, and, since then, has been noticed by most of the writers on foreign *bl ttidæ*. Saussure and Brunner have both figured and described it.

Several curious species are found in the driest parts of the interior, most of them broad and rugose, wingless, and well adapted to their surroundings. I have figured two of the largest in my "Notes on the Insects of Central Australia." *Polyzosteria pubescens*, of a uniform dark brown colour, is remarkable for the pubescent dorsal surface; and *Polyzosteria mitchelli*, with its richly-coloured integment of green and yellow, so different from the usual dull colour of these insects. A third, *Polyzosteria reflexa*, is a much smaller, rounded roach, of a dull chocolate colour, with the dorsal plates covered with short raised ridges or blunt spines tinged with dull yellow. A smaller rounded black species, distinctly striped along the hind margin of the three thoracic plates with dull yellow, has been described by Tepper from the same regions. Kirby lists twenty-one species of this typical Australian genus in his catalogue.

The Rotten-wood Cockroach (Panesthia lævicollis, *Saussure.*)

Fig. 7.

This is one of our commonest wingless cockroaches, found under half-rotten or decaying logs in the coastal scrubs. It does a great deal of burrowing into

the soft material, reducing it to the form of coarse sawdust, and, when disturbed, hides among the rubbish under the logs. It is of a uniform shining-black colour, elongate in form, with the upper surface of the thorax rugose, and the abdominal plates very solid and covered with scattered coarse punctures, thickest towards the tip; the anal plate irregularly serrate on the outer edge. The hind margin of the thorax is slightly constricted, with the wider abdomen rather convex and broadly-rounded at the apex. The legs of this species are stout and thickly clothed with spines.

It was described by Saussure in 1872, in the "Memoirs de la Societe Geneve," vol. XXIII. Kirby, in his "Catalogue of Orthoptera, British Museum," 1904, records seven species peculiar to Australia. Tepper, who identified this species for me, has determined another specimen, *Panesthia javanica*, ranging from Burma; but Kirby only lists it from as far south as Borneo and Java.

The Giant Cockroach (Geoscapheus giganteus, *Tepper*).

Fig. 6.

This immense cockroach comes from Central North Australia, and was described by Tepper in the "Transactions of the Royal Society of South Australia, 1894." There is a great disparity in the size of the sexes, the female measuring half an inch in length more than the male. A large female in my collection, obtained by Mrs. Black, of Pajuigo, Western Queensland, is nearly 2½ inches in length and 1½ inches across the middle of the back. The general colour is shining reddish brown, darkest on the rugose anal plate, which is bent downwards. The thoracic plate, hiding the head, is slightly turned up on the front margin, and finely rugose in front. The abdominal dorsal plates convex, and very lightly marked with fine scattered punctures, with the edges slightly curled, and a curious spine-like process on either side, above the anal segment.

Tepper has described a smaller, more rounded black species from Kalgoorlie, Western Australia, under the name of *Geoscapheus robustus*, and Saussure another of these typical wingless forms, allied to *G. giganteus*, which it much resembles in size and shape, except that it has the front of the thoracic plate curved into a blunt horn-like process above the head, from which peculiarity he called it *Macropanesthia rhinoceros*.

Remedies and Methods of dealing with Cockroaches in the House.

In ordinary cases, the different methods of poisoning are to be recommended. Smith, in his "Economic Entomology," says that he has found equal parts of powdered chocolate and borax, ground up thoroughly in a mortar, so that it is well mixed, and placed in their runs, very effective in getting rid of the cockroaches. Other writers advise the use of phosphorus paste, which is simply sweetened flour paste, containing 2 per cent. of phosphorus; this is spread on bits of wood or cardboard and placed in all the sheltered corners where the roaches congregate. During the last outbreak of plague, this mixture was distributed all over Sydney as rat poison, but I believe it killed an immense number of large American cockroaches wherever it was placed under the floors or cellars.

Borax with many different forms of food is used, but Mr. Tepper has recommended another method of inducing roaches to commit suicide. He first places a saucer containing one part of plaster of Paris to four of flour, well mixed, and close to it a saucer full of water, with a few sticks resting against the saucers, so that they can easily get to the food and water. The roach becomes thirsty after flour and plaster diet, and goes for the water, with the result that he gets small bricks in his inside that kill him.

An earthenware crock containing a few inches of stale beer, for which cockroaches have a great liking, and then a few handy sticks resting against the jar, so that they can climb up to get at the fluid, will often destroy great numbers.

The most successful method, where a large place is infested, is fumigation with hydrocyanic acid gas, which, if properly applied, penetrates into every corner, and suffocates big and little, most of them coming out of their hiding-places and dying on the floor, where they can be swept up in the morning and burnt, as where the fumigation has been weak, it is sometimes found that the roaches revive. For such fumigation, 1 lb. of cyanide of potassium to a pint of sulphuric acid, and three pints of water, will generate enough gas to poison 1,000 cubic feet of space. Bisulphide of carbon is sometimes used, but hydrocyanic acid gas has several advantages: first, it is not inflammable; secondly, it rises up on all sides, and is very volatile, while bisulphide, being a heavy gas, sinks down, and if not used in sufficient strength, will leave a stratum of unpoisoned air just where it is wanted most; and, lastly, the vile smell of bisulphide will hang round for some time after the room has been opened out, while hydrocyanic acid gas soon mixes with the air, and leaves no smell of any consequence behind. Riley considers that burning pyrethrum, or insect powder, will paralyse them, and even when it is simply scattered about on the shelves or corners, or puffed into cracks and crevices, will soon clear them out; but its virtue is but temporary, and it not only makes a mess on shelves and cupboards, but is an expensive remedy in large premises. Paris green is another very good thing to drive cockroaches away. It is scattered about or puffed into the corners where they hide, and is a more lasting poison than pyrethrum, but from its poisonous nature should be used with care and not left exposed. At the back of book-shelves and presses it is one of the best for roaches, silver-fish, and other insects of this class.

Burning black gunpowder in the infested kitchens is practised in Germany. The powder is damped and made up into little cones, "spitting jennies" we used to call them as boys. The fumes soon bring out the cockroaches, when they can be swept up and destroyed.

Mr. T. A. Janvers, writing in *Scribner's Magazine*, March, 1889, on "Mexican Superstitions and Folk Lore," says that the following is a formula practised by the Mexican villagers to get rid of cockroaches:—"Catch three and put them in a bottle, and so carry them to where two roads cross. Here hold the bottle upside down, and, as they fall out, repeat aloud three *credos*. Then all the cockroaches in the house from which these three come will go away."

portion of the tricalcic phosphate is converted into another lime compound, known as monocalcic phosphate or superphosphate. This compound is soluble in water, and it is to its presence that the rapid action of the phosphate is due. This is the "water-soluble" acid of the table. In many superphosphates, however, a considerable portion of this compound has undergone change. This change may be due to the salts of iron and alumina present, or to the length of time it has been kept, and it results in the formation of a third lime compound—bi-calcic phosphate. This is known as "reverted" or "retrograde" phosphoric acid, and is insoluble in water, but soluble in ammonium citrate.

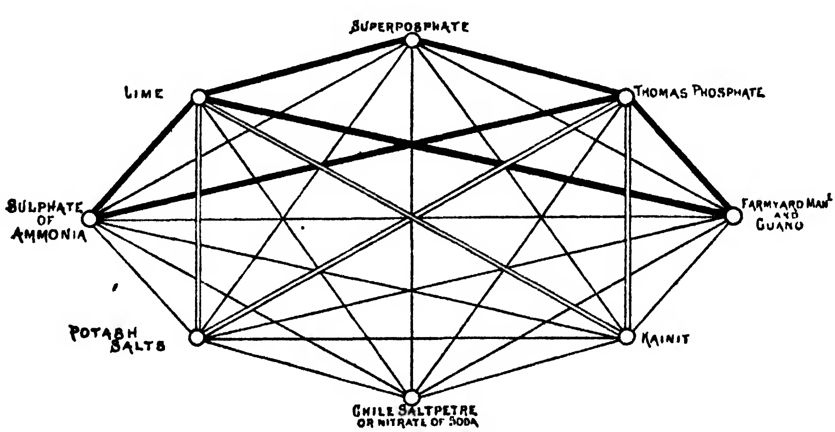
In the fourth table are a number of waste products which may in many cases be economically utilised.

WHEN purchasing a manure always insist on a guarantee of its composition as determined by analysis.

Artificial manures should be mixed with about three times their weight of dry loam, and distributed evenly.

Never add lime to a manure containing sulphate of ammonia or blood and bone manures, as in these cases losses of nitrogen results; and when lime has been applied to the land do not use such manures until about three weeks afterwards.

The accompanying fertiliser diagram, which represents in a graphic manner the points to be taken into consideration in the mixing of different manures, is reproduced in the hope that it will be found useful to farmers who make up their own mixtures. The diagram originates with Dr. Geekens, Alzey, Germany, and is taken from an article by Mr. Leo. Buring in the *Garden and Field* of 10th October, 1903.



Substances connected by thick line must not be mixed together.
Substances connected by double line must only be mixed immediately before use.
Substances connected by single thin line may be mixed together at any time.

1.—Simple Fertilisers.

Manure.	Where obtainable.	Guaranteed Composition. Nitrogen.	Equivalent to Ammonia.	Lime (CaO.)	Potash (K_2O).	Phosphoric Acid (P_2O_5).	Manurial Value. £ s. d.
Sulphate of Ammonia...	Australian Gaslight Co., Kent-street	20·4	24·8		......	......	14 0 6
Nitrate of Soda...	Gibbs, Bright, & Co., 37, Pitt-street	15 8	19·2	.....	......	......	12 6 3
,, ,,	"K.P.N." Fertiliser Co., 12, Spring-street	15·8	19·2	.....	......	......	12 6 3
Sulphate of Ammonia ...	,, ,,	20·4	24·8	.....	......	......	14 0 6
Kainit ...	,, ,,	......	......	.....	12·4	......	3 4 1
Muriate of Potash	,, ,,	......	......	.....	60·6	......	13 9 6
Sulphate of Potash	,, ,,	......	......	.....	52·4	......	13 10 9
Thomas Phosphate	,, ,,	......	......	.....	......	17·2	......
Nitrate of Soda...	Geo. Shirley & Co., 52 and 54, Pitt-street	15·8	19·2	.....	......	......	12 6 3
Building Lime* ...	Sydney and North Sydney Lime and Cement Co., 17, Pitt-street.	......	......	95· (about.)	......	......	......
Agricultural Lime*	,, ,,	......	......	60· (about.)	......	......	......
Nitrate of Soda...	R. S. Lamb & Co., 55, Pitt-street	15·8	19·2	.....	......	......	12 6 3
Kainit ...	Paton, Burns, & Co., Commercial Chambers, corner King and Sussex Streets.	......	......	.....	12·9	......	3 6 8
Sulphate of Potash	,, ,,	......	......	.....	52·	......	13 8 8
Nitrate of Soda...	,, ,,	15·8	19·2	.....	......	......	12 6 3
Gypsum*	,, ,,	......	......	96·6 % Crystallised $CaSO_4$	......	......	......
Gypsum Fertiliser*	A. H Hasell, 2, Bridge street			98· % Crystallised $CaSO_4$	......	......	......
Hasell's Kainit ...	,, ,,	......	......	.....	12·5	......	3 4 7

* Lime and Gypsum not guaranteed.

II.—Bone and Blood Manures.

Manure.	Where Obtainable.	Guaranteed Composition. Nitrogen.	Equivalent to Ammonia.	Phosphoric Acid.	Equivalent to Tri-calcic Phosphate.	Manurial Value. £ s. d.
Bone-dust digested, 40 per cent. ...	Co-operative Wholesale Society, 36–37, Royal Exchange.	3·5	4·25	17·5	38·2	4 17 5
Special fertiliser, No. 3 ...	,, ,, ,, ,,	5·36	6·5	17·5	38·2	6 2 10
Topdressing manure ...	Waratah Fertiliser Co., Ida-street, Waratah. ...	3·04	3·69	16·89	36·87	4 9 5
Dried blood	,, ,, ,, ,, ...	11·5	13·96	......	.....	7 17 2
Bone-dust	,, ,, ,, ,, ...	4·12	5·00	22·9	50	6 1 2
Bone and blood, B.B. ...	,, ,, ,, ,,	6·0	7·29	15	32·75	6 4 6
Dried blood	Colonial Fertilisers Co., 117, Pitt-street	10·7	13·00	......	.....	7 6 3
Bone-dust, B.D. 2 ...	Paton, Burns, & Co., Commercial Chambers, corner Sussex and King Streets.	3·7	4·49	22·12	48 29	5 13 3
,, B.D. 3 ...	,, ,, ,, ,, ...	3·3	4·00	20·7	45·19	5 3 9
,, B.D. 4 ...	,, ,, ,, ,, ...	3·3	4·00	18·4	40·17	4 17 3
Bone phosphate ...	,, ,, ,, ,, ...	.....	. .	27·48	60·	3 17 10
Nitrogenous bone-dust ..	,, ,, ,, ,, ...	4·94	6·00	13·74	30·	5 6 5
Bone and blood, B.B. ..	,, ,, ,, ,, ..	5·5	6·68	17·00	37·11	6 3 4
Blood	,, ,, ,, ,, ...	9·88	12·00	......	.....	6 15 1
Bone and blood manure ..	R. S. Lamb & Co., 55, Pitt-street.	5 76	7·00	13·74	30·	5 17 8
Green's A 1 bone-dust ...	,, ,, ,, ...	4 12	5 00	18·78	41·	5 9 6
* * * bone-dust ...	,, ,, ,, ...	3·91	4·75	23·82	52·	6 0 11
Raw bone-dust ...	,, ,, ,, ...	3·91	4·75	23 82	52·	6 0 11
Blood No. 1	,, ,, ,, ...	12·76	15·5	......	.....	8 14 5
,, No. 2	,, ,, ,, ...	12·35	15·00	......	.. ...	8 8 10
Vulture manure ...	,, ,, ,, ...	3·09	3 75	18 32	40·	4 14 2
Desiccated blood ...	A. Wooster, Epping	10·71	13·00	......	... ..	7 6 5
Blood and bone-dust ...	,, ,, ...	5·76	7·00	13·74	30·0	5 17 8
Pure steamed bone-dust ..	,, ,, ...	3·91	4·75	24·50	53·5	6 2 10
Phosphatic bone-dust ...	,, ,, ...	3·30	4·00	21·18	46·25	5 5 1
Nitrogenous bone-dust ..	,, ,, ...	5·46	6·64	16 03	35·00	6 0 0

III.—Superphosphates, Mixed Fertilisers, and Imported Fertilisers.

Manure.	Where obtainable.	Guaranteed Composition. Nitrogen.	Water soluble Phosphoric Acid.	Total Phosphoric Acid.	Potash (K_2O.)	Manurial Value. £ s. d.
Ohlendorff's Dissolved Peruvian Guano.	Gibbs, Bright, & Co., 37, Pitt-street	5·0	9·0	10·0	1·5	6 4 1
Superphosphate	"K.P.N." Fertiliser Co., 12 Spring-street . .	......	17·0	......	......	4 5 0
Superphospate (concentrated).	" " " .	... ..	41·0	......	......	10 5 0
A1 Superphosphates ..	Geo. Shirley & Co , 52 and 54, Pitt-street	. ...	18·78	.....	.	4 13 11
Superphosphates... No. 1	" "	... ..	16·5	......	.	4 2 6
Superphosphates... No. 3	" "	3·29	12·83	... .	2·0	5 19 9
Superphosphates... No. 5	" "	3·29	11·91	.. ..	7·0	7 0 11
Hasell's AA Superphosphate.	A. H. Hasell & Co., 2, Bridge-street	..	22·0	...	. . .	5 10 0
Hasell's A1 Superphosphate.	" "	.. .	18·5	.	.. .	4 12 6
Superphosphate	R. S. Lamb and Co., 55, Pitt-street . .	.	16·5	.	... ..	4 2 6
Superphosphate No. 1 ...	Paton, Burns, & Co., Commercial Chambers, corner King and Sussex streets.	. ..	16·9	.. ..	.... .	4 4 6

IV.—Waste-Products, Ashes, &c.

Manure.	Where obtainable.	Water.	Volatile and Combustible.	Nitrogen.	Ammonia.	Insoluble.	Lime.	Phosphoric Acid.	Potash.	Value.
										£ s. d.
Deposit from wool-scouring tanks. 1	Liverpool Wool-scouring Works.	...	...	·64	·78	...	...	...	·72	0 12 6
2	,, ,, ,,	...	...	1·02	1 24	...	...	·16	·39	0 16 5
3	,, ,, ,,	...	...	1·37	1·66	...	...	·14	·20	1 0 2
Deposit from breakers ..	,, ,, ,,	34·47		1 81	2·20	50 68	·85	·88	1·60	1 15 6
Sediment from wool-scouring works.	Yass ..	19·57		·59	71	78·24	·97	...	·20	0 9 1
Wool-waste ..	...	...	...	8 15	9·89	...	...	...	...	5 11 5
"Skutch" from limed pelts	Hugh Wright, Auburn	5·32	73·42	1·80	2·18	3·61	9·36	·89	·20	1 8 2
Decomposed hair and lime	Fellmongery	9·70	57·08	6·86	8·33	1·22	26·27	...	...	4 13 9
Tan-yard refuse	Tanneries, St. Marys	6·43	33·83	2·24	2 72	21·43	26·46	·67	...	1 12 6
Filter-press muck	Cane-mills, Broadwater	16 39	26·07	·22	·27	34·86	13·20	5·98*	·44	1 12 10
Megass	Clarence River cane	22·86	67·32	·63	·78	8·61	·30	·01	·05	0 8 11
Megass-ash	,, ,,	...	...	...	...	87·69	3·07	·16	·51	0 3 1
,,	Richmond ,,	...	...	...	...	...	1·11	·28	4·79	1 5 7
Bloodwood-ash	...	...	...	...	...	...	8 47	·27	5·25	1 7 11
Ironbark-ash	...	...	...	...	...	...	...	·82	1·53	0 10 3
Blackbutt-ash	...	...	...	...	...	...	7·27	·04	2·02	0 10 7
Red-gum-ash	...	...	...	...	...	...	...	·38	4 17	1 2 7
Spotted-gum-ash	...	...	...	...	...	...	...	·10	·70	0 3 11
Boxwood-ash	...	...	...	...	...	...	...	·67	1·65	0 10 5
Sea-weed-ash	...	...	...	...	...	...	9 27	·49	·59	0 4 5
Sea-weed-ash	...	...	...	...	...	...	6·29	1·27	17·55	4 14 3
Ash of grass-tree (*Xanthorrhœa arborea*).	...	0·86	1·78†	...	...	33 48	24·94	3·07	5·30	1 16 1
Vine-cuttings-ash	...	·49	...	...	...	60·64	11·34	1·85	3·76	1 4 8
Red-apple-ash	...	...	...	...	...	54·52	14·96	0·47	6·00	1 12 4
Ash of kerosene shale	Hartley Vale	1·49	27·93	·70	·85	67·59	...	·28	·14	0 11 1
She-oak-ash	...	...	...	...	...	8·57	42·35	8·85	2·19	1 16 5
Sea-weed, fresh state	...	80·00	...	·16	...	...	·41	·09	1·18	0 8 6
Sawdust	...	32 52	62·35	·82	1·00	...	...	1·70	·05	0 16 3
Cave-deposit, shells, &c.	Cowan, Hawkesbury River	2·11	...	·82	·99	...	35·40	1·59	·88	1 0 3
,,	Macleay River	23·06	16·01	2·43	2·95	26·77	13·88	7·40	...	2 14 2
Gypsum	Marulan	(Crystallised $CaSO_4 = 92·64$.)				4·47	...	...	...	...
Flue-deposit	Maitland	...	...	...	...	83·75	2·56	·32	·31	0 2 6
,,	Liverpool	...	...	...	...	91·17	·42	1·29	·17	0 4 6
,, from sanitary furnace	...	...	...	...	...	63·53	6·64	1·82	1·61	0 13 6
Night-soil mixed with lime	...	44·33		·74	·39	18·60	27·62	·78	...	0 12 4
Night-soil	Wagga Wagga	6·70		·03	0 4	82·19	·44	·28	·69	0 4 9
,,	,,	9 14		·28	·34	78·92	1·18	·18	·54	0 7 2
,,	,,			·50	·61	...	...	·64	·62	0 11 10

* 5 per cent. soluble in water. † Unburnt carbon.

IV.—Waste-Products, Ashes, &c.—*continued.*

Manure.	Where obtainable.	Water.	Volatile and Combustible.	Nitrogen.	Ammonia.	Insoluble.	Lime.	Phosphoric Acid.	Potash.	Value.
										£ s. d.
Night-soil preparation, No. 1 (*a*)	Wagga Wagga	8·22		3 73	4·63	50·22	13·32	9·65	·91	4 13 7
,, ,, No. 2 (*b*)	....	7·20		1·83	2·22	29·02	6·05	4·10	·15	2 4 0
,, ,, No. 3 (*c*)	....	25·95		1·64	1·99	60 17	1·39	1·61	·70	1 11 6
,, preparation, "Pinhoe" manure.	....	·92	9·54	·21	·25	57·58	14·71	1·26	·56	0 9 4
Night-soil preparation, No. 1 ..	F. Artlett, Parramatta ..	7·33	30·06	2·10	2·55	46·38	3·74 $CaCO_3$	1·92	·61	1 17 4
,, ,, ..	,, ..	10·11	42·59	4·97	6·03	·94	30·12	·39	....	3 9 1
,, ,, ..	Mr. "Halstead," O'Brien's patent.	1·54	12·36	·54	·65	77·95	....	·63	....	0 9 2
Farmyard-manure	....	67·96	22·09	·40	·49	8·16	·16	·20	·30	0 7 7
Fowl-manure	....	3·95	16·48	1·47	1·78	70·16	2·10	1·94	....	1 5 7
,, ...	... ...	1·54	15·23	·86	1·04	79·96	·64	·59	·38	0 15 2
Flying-fox-manure	....	1·09	35·34	3·34	4·05	50·29	1·02	0·36	1·15	2 12 7
Fish-manure	....	10·38	59·26	6·10	7·40	5·39	9·82	8·28	....	5 6 10
Sheep-manure	Liverpool Wool-scouring Works.	9·71	50·91	1·79	2·17	32·26	2· 0	·91	·92	1 11 10
Bat-guano	....	14·11	17·69	1·55	·88	28·77	13·72	11·42*	....	2 15 8
Bat-guano†	....	10·86	19 65	2·24	2 72	51·95	1·75	3·55	·15	2 3 8
Bat-guano‡	....	13·70	34 35	4·76	5·78	3·30	22·28	13·04	trace	5 5 4
Bat-deposit	Cave Flat, Cooradigbee .	5 43	12·98	·50	·61	57·64	5·60	12·12	....	2 1 2
Decayed wood (bark and leaves), bloodwood.	....	57·80		·74	·89	40·68	1·30	....	....	0 10 1
Decayed wood (bark and leaves), pepper tree.	....	79·92		·89	1·08	17·77	1·50	....	....	0 12 2
Muck from waterworks reservoir	Maitland	4·84	17·55	·74	·90	63·42	4·56	·31	·60	0 14 1
Cocoa-nut oil cake	Lever Brothers .. .	8·24	....	3·29	3·99	....	...	1·20	1·49	2 16 1
Bean-cake	North China	14·52	80·32	6·77	8·22	...	....	1·33	1·99	5 6 7
Field-pea, whole plant ..	....	88 58	9·97	·55	·67	....	·15	·12	·49	0 13 5
Tares, whole plant	....	83·97	14·96	·73	·88	....	....	·11	·21	0 11 5
Marsh-mallow, whole plant .	....	79·00	17·86	·85	1·03	....	....	·14	·69	0 15 7
Air-slacked lime	....	16·58	......	....	......	1·88	75·44	....	....	....
Residue from calcium carbide ..	....	41·36	....	....	......	1 08	36·19	....	....	....
Rice husks	....	42·71	42·15	1·07	1·30	13·77	·02	·03	·04	0 14 11
Sea-weed ash	Manly		... ..	......	....	43·06	6·52	·91	13·98	3 14 10
,, ...	,, ...	......	......	......	..	·07	·53	·19	34·30	3 17 9
Muck raked from a water-hole ..	. .. .	63 66	29·86	·81	·98	3·80	·96	·10	·06	0 11 8
Clinker from locomotive boiler ..	....	.....	.....	....	......	......	....	....	0·25	0 1 4
Bone breccia	Queanbeyan .. .	5·71	......	·59	·72	9·48	42·80	3·11	....	0 16 11
Castor cake	....	18·81	74·08	4·30	5·22	... ..	....	1·83	0·86	3 8 5
Pea cake	Java	16 02	......	7·24	8·79	.... ..	....	1·46	1·17	5 9 2

* 1 per cent. of the phosphoric acid is water-soluble. † The total nitrogen contains 1·12 nitric nitrogen, ·84 ammoniacal nitrogen, ·28 organic nitrogen. ‡ This analysis was made by Mr. J. C. H. Mingaye, and the total nitrogen contains 1·76 nitric nitrogen, ·64 ammoniacal nitrogen, and 2·42 organic nitrogen.
a 4·86 per cent. phosphoric acid is water-soluble. *b* 3·03 per cent. phosphoric acid is water-soluble. *c* ·42 per cent. phosphoric acid is water-soluble.

Cancer in a Cow.

JAS. D. STEWART, M.R.C.V.S.,
Government Veterinary Surgeon.

THE accompanying photograph was taken and forwarded by Mr. J. L. Maten, Inspector of Stock, Braidwood, who reports that the owner informed him that the growth first appeared as a warty excrescence which the cow rubbed off by accident, and then it grew to what is depicted in the photograph in about six months. It measured 18 inches in diameter at the base, and had the usual clinical appearance. The cow was destroyed. Specimens of the growth were examined at the Stock Branch Laboratory and proved to be of the character of an "epithelioma."

Cancer in a Cow.

Dairy Cattle and Horses at Wagga Experimental Farm.

G. M. McKEOWN.

Dairy Cattle.

During portion of most years, viz., from August to November inclusive, the natural pastures of the lower portions of the district are in excellent condition for dairying, and good returns may be obtained. In seasons such as the present (good rains having fallen in March), the profitable period is prolonged by good falls of rain early in the year, while the soil is warm

Jersey Cow.

enough to ensure a sufficient growth of grass to carry stock well over the winter. In most years, however, the grass is dry during the summer and autumn. The district therefore cannot be recommended as one in which to start dairying as a sole industry ; but in conjunction with other branches of farming, it may be carried on to a limited extent with a fair amount of profit. Conditions will naturally be found more favourable where the farmer is located convenient to railway stations, whence cream may be conveyed to the factories which exist at Wagga, Albury, and Cootamundra on the main line. The neighbourhood of townships also affords opportunities for the disposal of produce to private consumers.

Small-framed cattle have so far been found the most profitable, provided they are of good strains. Among these are the Jerseys and Ayrshires and their crosses. We have not, however, had an opportunity of comparing the

two pure breeds on the Experimental Farm. Most of the cattle on the Farm are Jerseys, but such of the cross-breds as possess a strain of the Ayrshire have given excellent yields, and have proved good doers in all seasons.

During last year the average yield from twenty-three cows was 5,162 lb., while the returns during the best period of the year, viz., August to November, averaged 2,516 lb.

The following sires have been used in the farm herd, viz., Newman (bred by Mr. S. H. Hyam).

Coral's Lad (bred by Mr. John Hay), by Mabel's Prince (imp.), from Coral (imp.)

Colleen's Golden Lad, by Melbourne, imp., from Colleen (imp.)

Among the cows are animals by Eridge Park, Gipsy King, Young Waikato, Neat Lad, Newman, and Coral's Lad.

Jersey Heifers; bred at Wagga Experimental Farm.

Following are some of the yields, all of the cows showing the shorter periods, being now milking, therefore they have been milked during the driest part of the year.

Name.	Breed.	Period.	Yield in lb.
Empress	Jersey	51 weeks	6,293
Cherry ... Grade	,,	48 ,,	5,731
Miriam	,,	56 ,,	5,311
Jessie	Jersey-Ayrshire	37 ,,	6,846
Violet ... Grade	Jersey	42 ,,	3,650
Nellie	,,	32 ,,	4,573
Iris	,,	34 ,,	5,383
Shamrock	,,	36 ,,	4,455
Nancy	,,	45 ,,	4,291
Gertie	,,	30 ,,	4,902
Flirt	,,	22 ,,	3,283
Elsie	,,	21 ,,	3,014
Daphne	,,	23 ,,	3,369
Dot	,,	23 ,,	3,052
Ranee	,,	24 ,,	3,473
Phyllis	,,	12 ,,	1,713
Myall	,,	11 ,,	1,456
Thistle ... Grade	,,	12 ,,	2,016

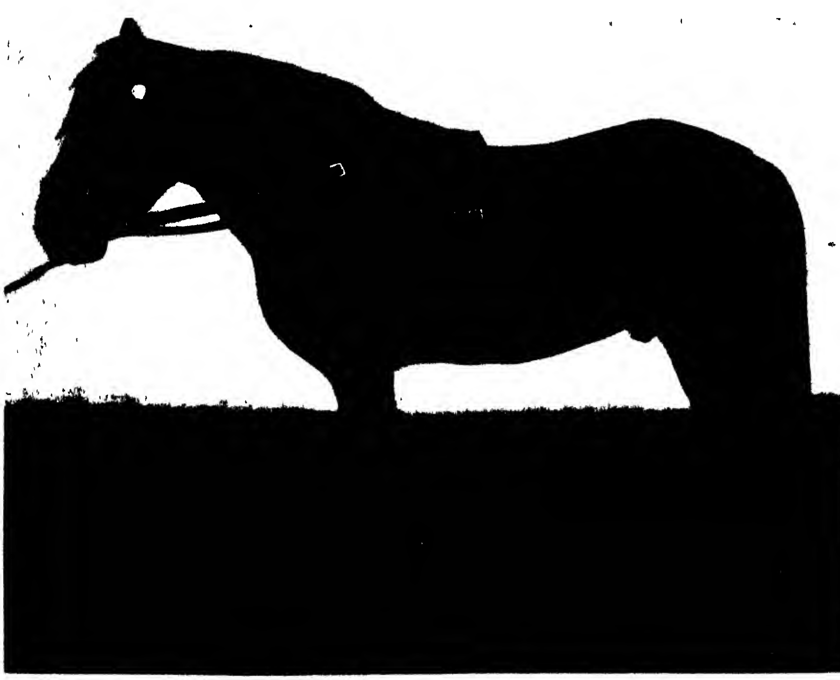
In the month of December there is very little, if any, green grass, therefore hand feeding is necessary until the growing season returns. For this purpose silage should be prepared in the seasons suitable for the production of desirable

fodder crops. One of the best of these is Skinless barley with a mixture of peas or vetches, which should be sown in March or April and cut when it is well out in head in September or October. Portion of the crop may also be used as green fodder if desired, but in most seasons it may be dispensed with, as September and October are included in the good months for natural pastures.

Bearded varieties of barley are undesirable for ensilage, as even when cut before any grain has formed, the awns or beards dry and become objectionable after having been removed from the stack and subjected to the action of sun and air for a short time. In good seasons sorghums may be sown in September and October for ensilage; but as it does not cure well here in stacks, it is desirable to provide a pit or overhead silo so that the material may be chaffed when filling. When grown under dry conditions, the crop appears to lack the moisture which is found in crops which are produced with an ample supply of moisture, therefore the loss in stacks is liable to be heavy.

Horses.

For some years it has been the practice to utilise mares which have not been able to do their full share of work for breeding, and since a stallion has



Suffolk Punch Stallion "Commander."

been added to the farm stock, we have extended the practice to others which are still full of vigour. In most cases a Suffolk Punch stallion has been used, but some of the young stock have been sired by active Clydesdales.

During portion of several summers it has been necessary to feed some of the mares which were past work, but for nine months of each year they were entirely grass-fed. All others have been grass-fed except when being worked.

The young horses which have been broken have proved most satisfactory, some of the Suffolk crosses having been used in every branch of farm and road work.

The stock are of high local value. Three mares which were past work have reared stock worth respectively £115, £110, and £75. Two others have reared young stock worth £145, and a few others now at work are suckling foals.

The stallion at present in use is "Commander," whose pedigree is as follows:—Sire, Scottish Chief (imp.), by Eclipse, dam Countess III, by Butley Boy (imp.); 2nd dam, Countess, by Sultan (imp.); 3rd dam, Gyp II, by Bowbearer (imp.); 4th dam, Gyp (imp.), by Magnum Bonum; 5th dam, Foxhall Ruby. Scottish Chief, by Eclipse, by Cupbearer III, dam Nectar, by Welland's Emperor; 2nd dam, Duchess, by Prince Imperial.

Fining White Wine.

In answer to a correspondent, regarding the use of Spanish clay and isinglass for fining white wine which is rather weak in tannin, Mr. Blunno, Viticultural Expert to the Department, supplies the following notes:—

"It is quite true that fining like Spanish clay or other earthy ingredients use up less tannin, in fact they do not use any at all, because they do not combine with any ingredient of the wine, their action being only mechanical. Spanish clay should, prior to its use, be finely pulverised, and then be kept for twenty-four hours in water, in which about 1 oz. of sulphuric acid has been mixed for every gallon. After twenty-four hours, the acidulated water is decanted, and the clay then washed in fresh water two or three times. This is necessary to remove all the carbonates which inquinate commercial Spanish clay.

"I would not advise the use of ordinary clay, which is bound to be inquinated with substances that will dissolve and taint the wine. The best and whitest kaolin is almost pure clay, and is used for fining white wine, but my experience is that some of its finest particles will take a rather long time to sink.

"Isinglass and gelatine fining require the presence in the wine of a certain amount of tannin to be effective. White wine contains only traces of, if any, tannin, therefore it is necessary to add some of this substance prior to adding the fining. A quantity of ½ lb. of tannic acid to a cask of 500 gallons is a suitable proportion. It is dissolved in a pint or two of brandy, poured into the cask, and the wine that is to be fined is pumped on top of it. A day or two after, the fining is added in the usual manner. In buying the tannin, applicant should insist on getting the purest, without that particular pharmaceutical smell characteristic of the ordinary commercial tannic acid."

Forestry.

Some Practical Notes on Forestry suitable for New South Wales.

[Continued from page 354.]

J. H. MAIDEN,
Government Botanist and Director of the Botanic Gardens, Sydney.

XIII—*continued.*

Fuel.

I suppose that the most important use to which New South Wales timbers are put is to burn them. We can divide Fuel into Household Fuel (and indeed this is the chief use) and Steaming Fuel.

Three years ago I asked for the information on which the present tables are compiled, they are not altogether satisfactory, but will serve as a basis for better lists.

The column "Vernacular name" represents the names supplied by the forest officers. The column "Botanical name" represents the name given to me (in a few cases) by the forest officer. In most cases it has been filled in by me after examination of material sent by him. In a number of cases requests for botanical material to enable me to fill up the column have elicited no response. It seems a little thing to ask foresters for a flowering or a fruiting twig of their forest-trees.

The woods are arranged in order of merit as fuel-woods. As a rule, six were supplied, as requested, rarely fewer or more.

SOUTH COAST AND MONARO.

Forest Officer and Locality.	Vernacular Name.	Botanical Name.
H. O. Rotton, Nowra ..	1. Ironbark	Eucalyptus paniculata.
	2. White Box ...	hemiphloia.
	3. Spotted Gum ..	maculata.
	4. Grey Gum	punctata.
	5. Bloodwood... ...	corymbosa.
	6. White Gum ...	hæmastoma.
	7. Forest Oak .	Casuarina torulosa.
John S. Allan, Cobargo	1. Ironbark	Eucalyptus paniculata.
	2. Box	Bosistoana.
		melliodora.
	3. Oak...	Casuarina suberosa.
		Cunninghamiana.
	4. Wattle	Acacia decurrens and other species.
	5. Spotted Gum ...	Eucalyptus maculata.
	6. Red Gum	tereticornis.

SOUTH COAST AND MONARO—*continued.*

Forest Officer and Locality.	Vernacular Name.	Botanical Name.
James C. Martin, Cooma	1. White Gum ...	Eucalyptus coriacea.
	2. Apple-tree... ..	Stuartiana.
	3. Wattle (Silver) ...	Acacia dealbata.
	4. Stunted Pine ...	Callitris calcarata.

NEAR WEST.

Forest Officer and Locality.	Vernacular Name.	Botanical Name.
J. B. Brown, Windsor...	1. Box...	Eucalyptus hemiphloia.
	2. Ironbark	crebra.
		siderophloia.
	3. Forest Oak ...	Casuarina torulosa.
	4. Wattle	Acacia decurrens.
	5. Grey Gum	Eucalyptus punctata.
	6. Bloodwood ...	corymbosa.
R. Sim, Capertee ...	1. Yarran	Acacia sp. (not homalophylla).
	2. White Box ...	Eucalyptus hemiphloia, var. albens.
	3. Yellow Box ...	melliodora.
	4. Ironbark	sideroxylon.
	5. Red Box or Slaty	polyanthemos.
	Gum	punctata.*
	6. Cabbage Gum ...	haemastoma, var. micrantha.
R. Deighton, Bathurst, Carcoar, Cowra, Lithgow, Molong, and Orange Districts.	1. White Box ...	Eucalyptus hemiphloia, var. albens.
	2. Yellow Box ...	melliodora.
	3. Ironbark	sideroxylon.
	4. Stringybark ...	macrorrhyncha (chiefly).
	5. Red Gum ..	tereticornis, var. dealbata.
	6. White Gum .	haemastoma, var. micrantha.

* *E. punctata* (usually known as Grey Gum) was also sent under the name of Slaty Gum.

RIVERINA.

Forest Officer and Locality.	Vernacular Name.	Botanical Name.
G. S. M. Grant, Balranald.	1. Myall or Boree ...	Acacia pendula.
	2. Belah	Casuarina lepidophloia.
	3. Malee	Eucalyptus incrassata, var. dumosa.
	4. Yarran	Acacia Oswaldi.*
	5. Swamp Box or Coolabah.	Eucalyptus bicolor.
	6. Grey Box	hemiphloia, var. albens.
Albert Chanter, Barham	1. Red Mallee ..	Eucalyptus oleosa.
	2. White Mallee ...	incrassata, var. dumosa.
	3. Grey Box	hemiphloia, var. albens, or Eucalyptus Woollsiana.
	4. Swamp Box ...	bicolor.
	5. Belah	Casuarina lepidophloia.
	6. Red Gum	Eucalyptus rostrata.

* Ordinary Yarran is *Acacia homalophylla*, not *Acacia Oswaldi*, but the latter is what was sent to me as Yarran.

RIVERINA—*continued.*

Forest Officer and Locality.	Vernacular Name.	Botanical Name.
Osborne Wilshire, Deniliquin.	1. Myall	Acacia pendula.
	2. Black Oak	Casuarina stricta.
	3. Grey Box	Eucalyptus Woollsiana.
	4. White Box... ...	hemiphloia, var. albens.
	5. Yellow Box ...	melliodora.
	6. Red Gum	rostrata.
	Household Fuel.	
Albert Beer, Moama ...	1. Grey Box	Eucalyptus hemiphloia, var. albens. Woollsiana.
	2. Red Box	polyanthemos.
	3. Red Gum	rostrata.
	4. Bellar or Bull Oak	Casuarina lepidophloia.
	5. Swamp Box ...	Eucalyptus bicolor.
	6. Yellow Box ..	melliodora.
	Steaming Fuel.	
	1. Grey Box	Eucalyptus hemiphloia, var. albens. Woollsiana.
	2. Red Gum	rostrata.
	3. Red Box	polyanthemos.
	4. Swamp Box .	bicolor.
	5. Bull Oak	Casuarina Luehmanni.
	6. Yellow Box ...	Eucalyptus melliodora.
	For Boilers working continuously day and night.	
	1. Red Gum	Eucalyptus rostrata.
	2. Grey Box	hemiphloia, var. albens. Woollsiana.
	3. Red Box	polyanthemos.
Arthur Osborne, Corowa	1. Oak..	Casuarina stricta.
	2. Grey Box	Eucalyptus hemiphloia, var. albens.
	3. Red Box	polyanthema.
	4. Ironbark	sideroxylon.
	5 Red Gum	rostrata.
	6. Pine	Callitris robusta.
Geo. Silcock, Urana ...	1. Box, grey	Eucalyptus hemiphloia var. albens.
	Box, red	polyanthemos.
	2. Oak	Casuarina stricta.
	3. Ironbark	Eucalyptus sideroxylon.
	4. Red Gum	rostrata.
	5. Pine	Callitris robusta.
	6. Stringybark ..	Eucalyptus macrorrhyncha.
Ralph Tate, Narrandera	1. Boree	Acacia pendula.
	2. Box... ...	Eucalyptus hemiphloia var. microcarpa.
	3. Red Gum	rostrata.
	4. Oak...	Casuarina Luehmanni and Casuarina Cunninghamiana.
	5. Pine	Callitris robusta.
	6 Mallee	Eucalyptus incrassata var. dumosa and others.

RIVERINA—*continued.*

Forest Officer and Locality.	Vernacular Name.	Botanical Names.
M. Tyrrell Day, Naringha, Gunbar.	1. Boree or Weeping Myall.	Acacia pendula.
	2. Yarran	homalophylla.
	3. Box...	Eucalyptus bicolor.
	4. Belah or Scrub Oak	Casuarina lepidophloia.
	5. Mallee	Eucalyptus incrassata var. dumosa and others.
	6. Pine	Callitris robusta.
Joseph E. Gormly, Wagga Wagga.	1. Boree	Acacia pendula.
	2. White and Grey Box.	Eucalyptus hemiphloia var. albens. Woollsiana.
	3. Yellow Box	melliodora.
	4. Ironbark	sideroxylon.
	5. White Pine ..	Callitris robusta.
	6. Red Gum	Eucalyptus rostrata.
M. T. Gaffney, Wagga Wagga (to Tumberumba).	1. Boree	Acacia pendula.
	2. Forest Oak ..	Casuarina stricta and Casuarina Luehmanni.
	3. Ironbark	Eucalyptus sideroxylon.
	4. Box, grey... ..	hemiphloia var. albens.
	black .	Woollsiana.
	yellow ..	melliodora.
	5. Pine (Cypress) .	Callitris robusta.
	6. Apple	Eucalyptus Stuartiana east of Wagga.
	7. Messmate.. ..	dives.
	8. Peppermint	amygdalina.
	9. Eurabbie	globulus.
	10. Stringybark	macrorrhyncha.
	11. Mountain Ash .	obliqua var. alpina (E. delegatensis).
John G. Postlethwaite Grenfell.	1. Boree or Myall ...	Acacia pendula.
	2. Yarran	homalophylla.
	3. Bull Oak	Casuarina *Luehmanni.
	4. Belah	*lepidophloia.
	5. Box, including—	
	White	Eucalyptus hemiphloia, var. albens.
	Yellow	melliodora.
	Red	polyanthemos.
	Bimbil	populifolia.
	6. Mallee	incrassata, var. dumosa.
T. B. Milligan ... .. Cootamundra.	1. Boree or Myall ..	Acacia pendula.
	2. Bull Oak	Casuarina Luehmanni.
	3. Box—white or gray	Eucalyptus hemiphloia var. albens.
	4. Ironbark	sideroxylon.
	5. Pine	Callitris robusta.
	6. Stringybark ...	Eucalyptus macrorrhyncha.

* S.W. of Grenfell and 60 miles from Cootamundra.—A. Osborne, 2,137-04 F.

FOOTNOTE.—"I do not give Pine as a good fuel-wood for general use, as it is dangerous, throwing out sparks and burning too fiercely, but it is the best for heating boilers and bakers' ovens. Stringybark is the best for brick-kilns and charcoal."—J. G. Postlethwaite.

WESTERN PLAINS.

Forest Officer and Locality.	Vernacular Name.	Botanical Name.
Jos. Walsh ... ... Condobolin.	1. Myall	Acacia pendula.
	2. Yarran	homalophylla.
	3. Budtha	Eremophila Mitchelli.
	4. Box	Eucalyptus Woollsiana.
		Baueriana, var. conica.
		populifolia.
	5. Belah	Casuarina lepidophloia.
	6. Pine .. .	Callitris robusta.
W. H. Tietkens Forbes.	1. White Box ..	Eucalyptus hemiphloia, var. albens.
	2. Grey Box	Woollsiana.
		Baueriana, var. conica.
	3. Oak...	Casuarina Luehmannia.
	4. Myall	Acacia pendula.
Geo. Langley . .. Dubbo.	1. Yarran	Acacia homalophylla.
	2. White Box ..	Eucalyptus hemiphloia, var. albens.
	3. Yellow Box ..	melliodora.
	4. Dead Myall .	Acacia pendula.
	5. She Oak	Casuarina stricta.
	6. Ironbark ..	Eucalyptus crebra.
		siderophloia.
		sideroxylon.
C. Marriott .. ... Dubbo.	1. Myall (dead) .	Acacia pendula.
	2. Yarran ...	homalophylla.
	3. Yellow Box	Eucalyptus melliodora.
	4. White Box ..	Baueriana, var. conica
	5. She Oak .. .	Casuarina Luehmanni.
	6. Ironbark ...	Eucalyptus sideroxylon.
Edward H. Taylor .. Coonamble.	1. Myall	Acacia pendula.
	2. Yarran . .	homalophylla.
	3. Belah	Casuarina lepidophloia.
	4. Oak..	Luehmanni.
	5. Ironbark	Eucalyptus crebra.
	6. Box... ...	populifolia (Bimbil).
		Woollsiana.
Edward B. Barton .. Bourke.	1. Gidgee .	Acacia Cambagei.
	2. Box	Eucalyptus bicolor.
	3. River Gum .	rostrata.
	4. Ironwood	Acacia excelsa.
	5. Belah ..	Casuarina lepidophloia.
	6. Coolabah	Eucalyptus microtheca.
T. Miller . ... Wilcannia.	1. Black Oak	Casuarina stricta.
	2. Bastard Box .	Eucalyptus bicolor.
	3. Nelia	Acacia sp. (not yet determined).
	4. Mulga	aneura.
	5. Gum	Eucalyptus fasiculosa.
		teriticornis, var. dealbata.
	6. Gidgee	Acacia Cambagei.

WESTERN PLAINS—*continued.*

Forest Officer and Locality.	Vernacular Name.	Botanical Names.
Herbert J. Lyne ... Narrabri.	1. Myall	Acacia pendula.
	2. Box...	Eucalyptus Woollsiana.
	3. Belah	Casuarina lepidophloia.
	4. Yarran	Acacia homalophylla.
	5. Forest Oak ...	Casuarina Luehmanni (?)
	6. Brigalow	Acacia harpophylla.
John Garland ... ... Moree.	1. Myall	Acacia pendula.
	2. Ironbark	Eucalyptus crebra. melanophloia.
	3. Belah	Casuarina lepidophloia.
	4. Coolabah	Eucalyptus microtheca.
	5. Bibble Box (Silver-leaved Box).	populifolia.
	6. Brigalow	Acacia harpophylla.
E. C. McPherson . Moree.	1. Myall	Acacia pendula.
	2. Box	Eucalyptus Woollsiana.
	3. Broad-leaf Ironbark	melanophloia.
	4. Brigalow	Acacia harpophylla.
	5. Coolabah	Eucalyptus microtheca.
	6. Belah	Casuarina lepidophloia.

NORTH COAST.

Forest Officer and Locality.	Vernacular Name.	Botanical Names.
John Martin ... . Brisbane Water.	1. Forest Oak... ...	Casuarina torulosa.
	2. Swamp Oak	glauca.
	3. Red Gum	Eucalyptus tereticornis.
	4. Red Gum . .	Angophora lanceolata.
	5. Blue Gum	Eucalyptus saligna.
	6. Ironbark	paniculata.
J. Hardiman ... ... Taree.	1. Ironbark	Eucalyptus paniculata.
	2. Box.. .	Tristania conferta.
	3. Oak... .. .	Casuarina suberosa.
	4. Gum	Eucalyptus tereticornis.
	5. Stringybark .	capitellata.
	6. Bloodwood	corymbosa.
Geo. Wiburd .. .. Kew, Camden Haven.	1. Forest .. ... and Swamp Oaks..	Casuarina suberosa. Cunninghamiana.
	2. Forest Box... ..	Eucalyptus hemiphloia.
	3. Red or Orange Gum	tereticornis.
	4. Ironbark	paniculata.
	5. Grey Gum	propinqua.
	6. Brush Box... ..	Tristania conferta.
	7. Tallow-wood ..	Eucalyptus microcorys.

NORTH COAST—*continued.*

Forest Officer and Locality.	Vernacular Name.	Botanical Name.
G. R. Brown ... ... Port Macquarie.	1. Forest Oak... ...	Casuarina torulosa. "A favourite fuel on account of it splitting so freely, also throwing out a good heat, and finally ending in clean ash."
	2. Black Oak	Casuarina suberosa. "This does not split so easily as 'Forest Oak' but is a good burning wood, and ending in a clean white ash, and as good heating wood."
	3. Swamp Oak ...	Casuarina glauca. "As good burning wood as either 'Forest Oak' or 'Black Oak,' but being a larger barrel tree, and heavier, not sought so much after by carters, therefore, not so much used; but with a similar ash."
	4. Tallow-wood ...	Eucalyptus microcorys. "Good when dry, has more charcoal than 'Forest Oak,' 'Black Oak,' or 'Swamp Oak;' keeps alight fairly well, throws a good heat, the cinders ending in a whitish powder."
	5. Ironbark	Eucalyptus paniculata, siderophloia. "All the species good burning timbers and throwing out great heat."
	6. White or Cabbage Gum.	Eucalyptus hæmastoma. "When dry a fair burning wood, throws out as great heat as Ironbark, not often used."
	7. Bloodwood ..	Eucalyptus corymbosa. "Favourite for furnace work."
	8. Grey Gum.. ...	Eucalyptus tereticornis. "Spoken of by some as good fuel, but not in general use."
	9. Blackbutt	Eucalyptus pilularis. "Considered good fuel, if the limbs are used."
	10. Brush Box ...	Tristania conferta. "A good wood for smouldering slowly, and will not go out until all burnt." (G. R. Brown, Port Macquarie, 12th May, 1902.)
W. F. Crowley.. .. Port Macquarie.	1. Ironbark	Eucalyptus paniculata.
	2. Forest Oak ...	Casuarina torulosa.
	3. Grey Gum... ..	Eucalyptus propinqua.
	4. Tallow-wood ..	" microcorys.
	5. Brush Box . ..	Tristania conferta.
	6. Bloodwood	Eucalyptus corymbosa.
J. F. Booth ... ... Bellingen.	1. Oak...	Casuarina Cunninghamana.
	2. Gum (chiefly Spotted Gum).	Eucalyptus maculata.
	3. Ironbark	" paniculata.
	4. Brush Box... ...	Tristania conferta.
	5. Bloodwood... ...	Eucalyptus corymbosa.
	6. Blackbutt	" pilularis.

NORTH COAST—*continued.*

Forest Officer and Locality.	Vernacular Name.	Botanical Name.
T. H. Wilshire ... Grafton.	1. Box ..	Eucalyptus hemiphloia.
	2. Grey Ironbark	paniculata.
	3. Spotted Gum	maculata.
	4. Swamp Oak	Casuarina glauca.
	5. Wattle	Acacia decurrens.
	6. Forest Oak	Casuarina suberosa.
F. S. Boyd .. Lismore.	1. Ironbark ...	Eucalyptus paniculata.
	2. Tallow-wood	microcorys.
	3. Bloodwood	corymbosa.
	4. White Box	Tristania conferta.
	5. Red Gum ..	Eucalyptus tereticornis.
	6. Forest Oak	Casuarina torulosa.
W. P. Pope ... Casino.	1. Forest Oak	Casuarina torulosa.
	2. White Box	Tristania conferta.
	3. Bloodwood .	Eucalyptus corymbosa.
	4. Grey Ironbark	paniculata.
	5. Grey Box ...	hemiphloia.
	6. Blue Gum ...	saligna.
W. MacDonald... Curlewis.	1. Myall ..	Acacia pendula.
	Yarran ...	homalophylla.
	2. White Box ..	Eucalyptus hemiphloia, var. albens.
	3. Forest Oak	Casuarina Luehmanni.
	4. Belah ...	lepidophloia.
	5. Ironbark ...	Eucalyptus crebra.
	6 Yellow Box	melliodora.
A. E. Stopford ... Armidale.	1. Yellow Box	Eucalyptus melliodora "Burns well; white ash."
	2. Red Gum ..	Eucalyptus tereticornis. "Burns well; black and white ash."
	3. Stringybark	Eucalyptus macrorrhyncha. "Burns fairly, if dry; light ash."
	4. Peppermint	Eucalyptus nova anglica.
	5. White Gum	stellulata.
	6. Box ...	hemiphloia.
	Blackbutt ..	"Burns fairly well,—blackish ash."
	Brush Box .	"Burns well (burns green),—white ash."
	Grey Ironbark	"Burns well,—white ash."
	Grey Box ..	"Burns well,—white ash."
	Messmate ..	"Burns badly,—dark ash."
	Spotted Gum ..	"Burns well,—whitish ash."
	Tallow-wood ...	"Burns fairly well,—whitish ash."
	Bloodwood ...	"Burns fairly well,—darkish ash."
	Grey Gum ...	"Burns fairly well,—light ash."
	Red Ironbark...	"Burns well,—darkish ash."
	Red Mahogany	"Burns badly—dark ash."
	Sydney Bluegum	"Burns fairly well,—grey ash."
	Woollybutt ...	"Burns very badly,—dark ash."

I have classified these results in the following table, not going beyond the sixth place. Myall (a western timber) is easily first, having obtained no less than fifteen first-classes. Then comes Yarran, another western timber, with three firsts and five seconds. Ironbark has five first classes. As a rule, the kind of Ironbark is not specified. The Boxes stand high. Box (unspecified) two first and six second classes, while White Box has similar results. Grey Box and Yellow Box come next. Red Gum is good. She Oaks are good,—Forest Oak receiving most "votes."

FIREWOODS.

Vernacular Name.	Position.					
	1	2	3	4	5	6
Ironbark	5	2	4	5	3	3
Broadleaf ...	...	...	1	...	...	...
Grey	...	1	...	2	...	...
Box	2	6	1	1	...	2
White...	2	6	1	3	1	...
Forest	...	1	...	..	...	...
Brush	...	...	...	1	1	1
Black	...	...	..	1	...	...
Swamp, or Coolabah..	...	..	.	1	2	2
Grey	2	3	2	1	1	1
Yellow	1	1	4	1	2	2
Red	1	1	1	...	2	...
Bimbil or Bibble .	...	...	...	...	2	..
Bastard	..	1	...	...	...	...
Gum		...	...	1	1	...
River	...	...	1	..	...	...
Slaty	.	...	..	...	1	...
Cabbage .. .	..	...	...	...	..	1
Red	.	1	4	2	3	4
White.	1	...	...	..	1	3
Blue	..	...	..	..	1	1
Spotted .	..	1	1	1	1	...
Grey ...	.	..	1	1	2	...
Peppermint . .	...	..	...	1	..	...
Blackbutt . . .	..	...	.	...	..	1
Budtha	..	.	1	..	..	...
Tallow-wood	...	1	..	2	..	...
Oak	2	1	3	2	2	..
Black .. .	1	2	..	...	.	.
Forest .	4	2	2	...	1	2
Swamp	1	1	1	1	...	...
Bull	.	1	1	.	.	..
Gidgee	1	.	.	.		1
Ironwood	...	..	.	1	...	...
Coolabah . ..	..	.	...	1	1	1
Nelia	...	...	1	..	..	...
Mulga . . .	.	...	..	1	..	..
Brigalow . . .	...	.		1	.	2
Belar, Belah	...	1	3	4	3	1
Mallee	...	..	1	...	1	2
Red	1	..	...	.	...	...
White	...	1	...	.	...	...
Yarran	3	5	...	2	...	...
Pine	...	...	...	..	3	3
White...	...	.	...	...	1	...
Cypress	...	...	...	...	1	...
Stunted	...	...	...	1	...	...
Stringybark	...	...	1	1	1	2
Bloodwood	...	...	2	...	2	3
Wattle	...	...	...	2	1	...
Silver	...	...	1	...	...	..
Apple Tree	...	1	...	...	..	1
Myall or Boree	15	...	...	2	...	...

On a future occasion I may, perhaps, classify our timbers according to the properties and values of their respective charcoals.

Botanical Work at Hawkesbury Agricultural College.

C. T. MUSSON.

Growers in the course of raising crops are dealing with living things about which the great majority of men know nothing, at least as to their methods of assimilating and digesting food, the diseases they are subject to, and all the many and very varied circumstance exhibited by them during their life period, whether short or long. The prevalence of many enemies presents one of the most serious obstacles in the way of the modern producer; whether insect pest, parasitic fungus, or some mechanical cause is responsible for the damage, it is none the less a fact, and in all Agricultural Colleges the study of pests takes a prominent place.

The writer has been on several occasions asked: Do you teach anything about Plant Disease at the College? Probably only those who have gone through the Botanical course are aware that the subject is dealt with in considerable detail. It may be worth while explaining to readers something of the work done in our Botanical Department. It is to be regretted that a large portion of the two years constituting our full college course must necessarily be taken up with working through the elements of plant knowledge, so far as is necessary to agricultural students; but it has to be done. No person can expect to get a better understanding of plants, their food, diseases, and other branches of the subject without first making himself acquainted with the elements, external and internal structure, habits of life, and methods of work. Plants are living things, and of all such, are perhaps the most difficult to get to know thoroughly from the required point of view. Therefore the first thing we do is to try and interest our would-be producers in the life history and structure of the plants they have to deal with. We, none of us fully realise what delicate and responsive subjects plants are. So, during the first five months, a course of lectures is delivered explaining such matters as are deemed necessary; living plants, illustrations, blackboard sketches, microscopes for magnifying purposes are freely used in making the details as clear as possible. Learners have to handle the examples used, dissect them where required, and record by sketches and in writing the results of their observations. Everything is made as practical as possible. Growing crops, weeds, grasses, trees, and all the multifarious manifestations of plant life surrounding us provide the material required. All features of interest occurring on the farm, in the orchard, experiment farm, or irrigation plots are made use of as far as possible, the outside and inside work being brought into touch throughout.

Periodical walks are taken to the various departments of the farm for inspection purposes; to study the composition of the plant covering of our paddocks, especially in respect of useful plants, grasses, and herbs, and detrimental plants; to get to know them by name; also to obtain specimens for closer study; to take part in special operations, such as budding, grafting, pruning, and spraying; all this in addition to such regular share of work as may fall to students in the ordinary course of their working days.

Special importance is attached to students making themselves acquainted with the grasses, trees, poisonous and other weeds, as well as fodder plants. To this end they are expected to collect, dry, arrange, and obtain names for a set of local plants. They are encouraged to bring plants of interest, or send them, from their homes; and to send us the more prominent weeds, pests, or other objects of interest in this line after leaving college. Many useful specimens have thus been received. Then a good deal of work is done in the way of preparing starch and other products from various plants as opportunity offers; quite sufficient is done to enable anyone going through the subject to get a fair grasp of it as far as it goes.

Another important branch of work is that of seed-testing. In this line ample opportunity is afforded for studying its value and the methods adopted. Students take part in actual tests; compare and grade seed used on the farm. A collection of crop and weed seeds is in use; many of the latter picked out of commercial samples of various seeds, bought, or sent for examination, or from our own area. This seed-testing has been of great use in our farm-work, it is indeed frequently of special use in saving valuable time by causing the rejection of certain bad seed before planting in favour of good samples.

Much of the work here necessitates a knowledge of the compound microscope and how to use it; therefore some considerable time is devoted to examination of plants by its means. Frequently plants, fruits, pests, and other things are sent in for us to report upon, and are used for class-work; full diagnosis is not possible without microscopic assistance. The work is interesting. Thin slices (sections), or special portions, are prepared and examined, drawings being made of such features as it may be considered desirable to record. It is only by microscopical examination that the real structure of the plants as to their component parts can be made out. Once we understand how wood is formed; what fibres are, how starch is formed and stored; how to recognise the parasitic fungus by its body or fruiting organs (spores); the structure and work of leaves; how plants feed and reproduce, it is easy to grasp the usefulness of such knowledge, and to follow up in a more thorough manner our practice in plant-growing and breeding. Such knowledge will be indispensable to the agriculture of the future, and gives us reasons why for many of our operations.

Another matter upon which special emphasis is laid is in relation to our native fodder-plants, grasses, and other herbs, in that these should be made more use of by conserving and cultivating them in every possible way; they are the fodder plants of the greater part of our country area. They are being

eaten out and do not get the chances they require to reproduce themselves and grow; if any reason is wanted to show why this is advisable, it is only necessary to say that they *are acclimatised*, and to a great extent able to resist the extreme conditions of our peculiar climate much better (for our dry regions) than most introduced plants. There should be universally wide-spread action in this direction. We may plant introduced things with much advantage, but at bottom there is nothing like the grasses and other fodder-plants that are accustomed to their surroundings. Seed should be saved, planted, and encouraged wherever possible. Comprehensive, and certainly very important work is done in the subject of plant diseases; every possible opportunity is taken to give such instruction by lectures and by actual examination of the diseased plants as to enable any interested person—

(1) To diagnose the chief plant diseases, and judge what is causing the trouble; this understood,

(2) To formulate some practicable, successful, and inexpensive treatment.

Now, although all growers cannot become plant doctors, it would be an immense boon to any man if he were able to tell what is wrong and to know the best remedy. Time (even a few hours) is frequently of supreme importance in checking attack; drastic, immediate treatment might stamp out a newly introduced pest, while time wasted waiting for expert opinion might enable it to make good its foothold. Worse, much worse, is the attitude of the man who leaves it alone altogether. There are numbers of pests we ought to be prepared for by knowing them; we are thus forearmed as well as forewarned. Moreover, by spreading amongst producers this knowledge, it is more likely that, knowing what to do, they will start off and do it. Such ideas are best disseminated amongst the young, who are to be the farmers of the future. Want of knowledge has much to do with "fixing" the old time dictum, "What my father did is good enough for me." People are waking up to the value of treating for disease; though insect pests receive more attention, perhaps, than do those caused by fungus parasites. In a recent book,* the writer says in effect, "If I were to sum up the most important result of the advances made during the past decade in Agriculture and Forestry, I should reply,—The clearer and wider recognition of the fact that the plant itself is the centre of the subject. The more far-seeing pioneers of scientific agriculture are recognising that agricultural chemistry is not the be-all and end-all of agricultural science; but that the student should have his attention more concentrated on the living plant itself, and on the physiological actions which make up its life."

The Botanical work here is carried on in this spirit. We know comparatively little as to a plant's ways of life as yet, but our knowledge is growing. Did we know about plants but a little of what we know as to animals, we should be able to do much more with them than is at present possible.

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* Disease in Plants. H. Marshall Ward, F.R.S.

There is every reason why we should keep on in the direction of doctoring plants; they need it; we *know* they need it; and yet we often sit still and allow ourselves to lose crops. Fortunately knowledge in this direction is spreading. Largely through departmental and college work, growers are gradually learning that it pays handsomely to treat plants for disease. It is not speaking too strongly to say that we ought to pay as much attention to plants in the matter of health and disease as our animals receive. Indeed, perhaps, more care is necessary; there are so many diverse circumstances to fight against; and, like animals, the more attention they get the more they require. Not until plants are treated more on the lines adopted with animals—under a full conviction that it pays- shall we ever appreciably approach the ideal of getting fairly full and clean crops, an ideal not altogether visionary. At present we do plants but scant justice. We may rest assured that the time will come when our antiquated methods will die out; the plant-understanding man and the plant doctor will come to stay. The subject is taken up here at all events in all seriousness.

We seek to make students feel that work here is only the beginning of a lifetime's study.—"Student here he should always be a student." If he realises this, well! if not, then the knowledge he has gained here is not of full use to him. With us he is placed on a track which, if followed up, must lead to results; for instance, he might take up a practical study of poison plants, or go into the raising of special new races, to mention only two lines of valuable work.

The study of plants here ought certainly to bring the real student, the fellow with an object in life, in close touch with his subject. He ought to leave us well posted up in a general knowledge of the plants he is to live with, cultivate, and use.

I can look back over an experience of thirty years in plant study, and twenty in the teaching of Botany. The methods used and opportunities for practical work are infinitely better now than they were; if anything, we err too much in the direction of spoon-feeding now-a-days. In my early student days it was all lecturing, now it is argely practical work in the laboratory or the field, sufficient lecturing being done to build up a framework of the subject, which is filled in by demonstrations and actual examination of the things talked about; the lectures and practical work go hand in hand. Every effort is made to guide observers into finding out for themselves rather than explain everything for them, in order to encourage the observant and reasoning faculties. This is found, however, to be anything but an easy thing to accomplish, consequent, it is believed, upon the want of early training in this direction. What is meant is this: if students taking up Botany here had already done the elements of that subject, three months' work at least would be saved, and what is more important, they would be ready straight away to begin observing and reasoning on more interesting lines than the early work can apparently give. That there is a want of thinking power amongst us is soon demonstrated on undertaking a class in this or any other subject. Attending lectures, however, will alone give the true spirit required.

Botany is certainly one of the best of studies for cultivating the eye and mind; as a hobby it cannot be surpassed. Plants of many kinds, illustrating every phase of their lives, are readily obtained. It entails little or no expense. It exercises and extends the powers of observation, and gives a lively interest in one aspect of nature. If, then, it is of interest to a general student merely as a hobby, how much more so should it be to those who are to use them for their own livelihood and special convenience.

To do the best work here in Agricultural Botany, a student should know the elements of his subject; should be able to draw, however roughly, what he sees; above all, he should come prepared to believe that the work is useful. We can then try to cultivate the seeing eye and the thinking mind.

There is no doubt that to many men a study of plants (called Botany), even in such a college as ours, where the subject touches at many points the actual outside work, is just so much time wasted. The receptive mind is not there! But for the man who is prepared to enter into the subject with an open mind and endeavours to get into the spirit of the thing, I can conceive no more useful subject than a good grounding in the principles of plant structure and the functions of the various parts.

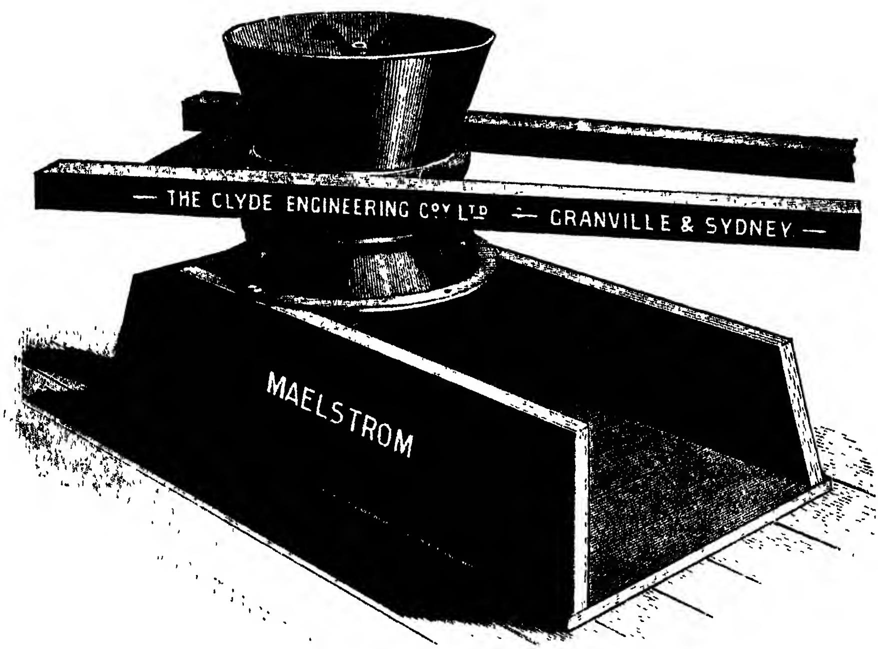
It is a knowledge of the life needs, and habits of plants the grower wants. To know the proper terms to apply to each differently shaped leaf is not necessary, and is not taught here, though it is useful under some circumstances. To know the proper Latin names of the plants on his place is certainly useful to a man; it is with plants as with human acquaintance, intimate knowledge soon makes us familiar with names and other details. We soon begin to separate off in our minds what is worth knowing and what may best be left alone. This power of selection in relation to what is useful and what is not is valuable and comes with use.

To come into touch with the plants we deal with from as many points of view as possible, and in all phases of their lives; to try and know their wants; to endeavour to attain the power to diagnose any disease; to look on them as living things, working for us, and in which we ought to take the most intense interest—it is in this spirit and with these aims that the subject of Botany is dealt with at the Hawkesbury Agricultural College.

Value of Ground Maize Cobs

R. H. GENNYS,
Glen Innes Experimental Farm.

MANY farmers do not appear to recognise that there is any value whatever in maize cores, and yet Mr. F. B. Guthrie, Chemist to the Department of Agriculture, has shown that nearly 50 per cent. is nutrient material, and when the cores and grain—that is, the whole cob—is ground up, the total



The "Maelstrom" Feed Grinder.

nutrients reach 67 per cent. Experiments have shown, although the maize grain by itself contains 85 per cent. of nutrients, yet when fed alone, it is too heavy and heating and not easily digested, but when fed with the core added makes a well-balanced and fattening ration.

Mr. Guthrie further states that the meal has been profitably employed in pig fattening. The addition of oil-cake or molasses to material like corn-cob

meal would be of advantage. The feeding value of corn-cob meal, meal of grain and core crushed together, and maize-meal, is given in the following table:—

	Corn-cob core-meal.	Mixture, half maize, half core	Maize without core.
Water ...	13·5	12·2	10·9
Ash ...	1·6	1·5	1·5
Fibre ...	35·3	18·7	2·1
Nutrient matter—			
Albumenoids ..	4·5	7·5	10·5
Carbohydrates	44·5	57	69·6
Fat and oil	·6	3	5 4
		100	100·
Total nutrients	49·6	67·5	85·5
Albumenoid ratio	—	1 to 8	1 to 8

With respect to this matter I have quite recently had an experience which proves the value of the above for pig feeding, and this is not with cobs that have fully matured but those which, owing to the shortness of the season here, did not ripen but were partially shrivelled up and quite valueless and unsaleable unless crushed up. I had a quantity of this last year and the question was whether it was advisable to leave the crop in the field and burn it or pull it and crush it up. Having the assent of my Department a "Maelstrom" or "Corn Cob Grinder" was purchased, also some store pigs, the price paid for eleven of these was £7, for a few days the cobs were thrown in to them with other material, but when the "Maelstrom" got to work they were fed almost solely on the meal of these shrivelled wretched-looking maize cobs and water. The pigs devoured the meal—which was not ground very fine—readily, and in twenty-one weeks were sold for £22; now these maize cobs if not used in this way were absolutely waste products. We also fed our farm horses on this and chaff for some time, they were fairly hard at work during the period and held their own well.

I have no doubt that this will also prove a valuable food for milking cows, more especially if fed with molasses.

The cost of the "Maelstrom" or "Corn Cob Grinder" was £7 18s. 6d.

The following statement will approximately show profits on eleven pigs fattened on meal made from unmarketable corn cobs crushed up and fed with water only mixed with the meal.

	£	s.	d.
Price paid for pigs	7	0	0
Labour of boy grinding, &c.	1	1	0
Harvesting cobs	2	2	0
Horse feed	0	6	0
	£10	9	0

Sold pigs for £22. Profit, £11 11s

Blacksmithing on the Farm.

A GREAT deal is written about the necessity of a workshop on the farm. The farm workshop which is usually spoken of, if we may judge by the description given, has more the appearance of a carpenter's shop than anything else. While something of this kind should be on every farm, at the same time no farmer should attempt to get along in this age without a blacksmith shop, owing to the fact that nearly all farm machinery is made very largely from iron and steel.

On account of sparks from the forge, when in operation, a building for this purpose should be erected at such a distance that the possibility of fire would be reduced to a minimum. Always choose a high, dry spot when selecting a site for a blacksmith shop, for the reason that dampness in a building used for this purpose causes the tools to become rusty, which would eventually destroy their usefulness.

A building which answers the purpose very well need not be more than 10 by 12 feet square, and about 7 feet high. Good sheeting, or slabs, with battens nailed over the cracks, is all that is necessary for the sides. The roof should be made thoroughly water-tight and pitched both ways, with a hole in each gable about 10 inches square, up near the cone, to carry off the sulphur fumes.

Next in importance is the tools. When purchasing a forge, anvil, blacksmith's tongs, stocks and dies—in fact, all tools necessary for a complete blacksmith's outfit for the farm,—no greater mistake can be made than that of buying what is called a "cheap set." Many times this class of tools have been the cause of leading the farmer to thinking he was incapable of doing his own work, when, as a matter of fact, it is the tools that are not equal to the demands made upon them. In nearly every instance farmers who have tried the cheaper sets, thinking to save a few shillings at the start, have found it to be the dearest in the end.

The high-standing portable lever forge is the best kind for farm use. What I meant by the high-standing is the kind that is 33 inches from the ground to the fire pan—not those with short legs, which necessitates having a block to stand them on to make them high enough for use. The fan should not be less than the 7-inch size, and the fire pan should be oblong, not less than 15 by 19 inches. This size forge is equal to any work the farmer is called upon to do.

It is not necessary to buy a new 140 lb. anvil, which is the proper size to get, when by looking around a second-hand one this size can often be found

at a blacksmith's shop in the home town, which is plenty good enough for an amateur. Whatever you do, do not buy a small anvil, or attempt to get along with a piece of railroad iron. A good second-hand anvil, stapled to a solid block from 12 to 16 inches high, is worth many times more than a new, small, inferior one.

After having settled in your mind what you prefer as regards forge and anvil, the next to be thoroughly considered is the smaller tools, such as tongs, hardie, hand hammer, vice, stocks, and dies, &c. We will suggest to you the size of these different tools in the order named that will in all probability give the best satisfaction.

For ordinary work, it is necessary to have two pairs of straight-lipped blacksmith's tongs, one pair 20 inches, the other pair 22 inches in length. While there is not much difference in the length, there is considerable difference in the weight—one pair for light and the other pair for heavy work. The size of the hardie, or cutter, is governed by the square hole in the anvil. When selecting a hand or forge hammer, do not fall into the common error of getting one too light; a $2\frac{3}{4}$ or 3 lb. hammer is a good size for beating out ploughshares and doing ordinary work. The cooling process commences as soon as the iron leaves the fire; hence the reason for a heavy hammer to make every stroke count, for with iron, more than steel, if not worked in a good heat becomes hollow and useless.

The best kind of vice, one giving the most general satisfaction among farmers is the medium blacksmith's vice.

Of all the tools necessary to make a complete blacksmith's outfit for the farmer, there is none of more importance than the stocks and dies. On account of the different number of threads to the inch in bolt dies, too much care cannot be exercised at the time of purchase to get taps and dies with the same number of threads to the inch that are on the bolts used in your machinery. The way to determine this is by a rule on the threads of different size bolts commonly used, and count the number of threads to the inch. The most convenient size stocks and dies for farmers' use are those which cut from 1 inch to $\frac{7}{8}$ inch right-hand eight, ten, and twelve threads to the inch, and has three taps and three sets of dies.

While a drill is not of so much importance to the farmer as the tools mentioned, at the same time no blacksmith shop is properly equipped without one. Should the purchase of a drill be contemplated, do not buy the cheap horizontal kind. Choose what is called the "hard feed post drill." A drill of this description can be bolted to the side of the shop, is out of the way, always solid when properly fixed, which adds very much to its value. For no one knows, except those who have tried, the amount of discomfort there is attached to a drill that is compelled to be held steady with one hand while drilling with the other.

It will be noticed all the way through that purchasing the better grade of tools is advocated, which costs a little more money at the start, but will more than save the difference in a very short time. These recommendations

are based upon experience, and undoubtedly will prove beneficial to those acting upon them. To a great many the blacksmithing proposition will in all probability not be sufficiently clear to warrant them acting upon this suggestion, owing to lack of experience in this kind of work. It seems that most farmers are natural-born carpenters, and can build or repair anything that is constructed from wood, but take particular pains to keep clear of jobs where an iron-worker's skill is needed. From this it must not be inferred that the mere fact of farmers getting a set of blacksmith's tools they would immediately be able to do all their blacksmithing, but it is astonishing how quickly the amateur learns to do small jobs and thereby save a trip to town, which makes the blacksmith shop on the farm a profitable investment.—Extracts from *Nebraska Farmer*.

How to get rid of Cockroaches.

In answer to a correspondent, Mr. W. W. Froggatt, Entomologist to the Department of Agriculture, supplies the following note:—

An article dealing with cockroaches appears in this issue of the *Gazette*. Among the remedies used in the ordinary house where the run or hiding-places of the pests are located, is to puff in Paris green. An excellent bait is powdered chocolate and borax, equal parts; grind it up in a mortar, so that it is thoroughly mixed; dust this into their hiding-places or place in bunches here and there, covering up all food at the same time.

Farmers' Fowls.

[Continued from page 386.]

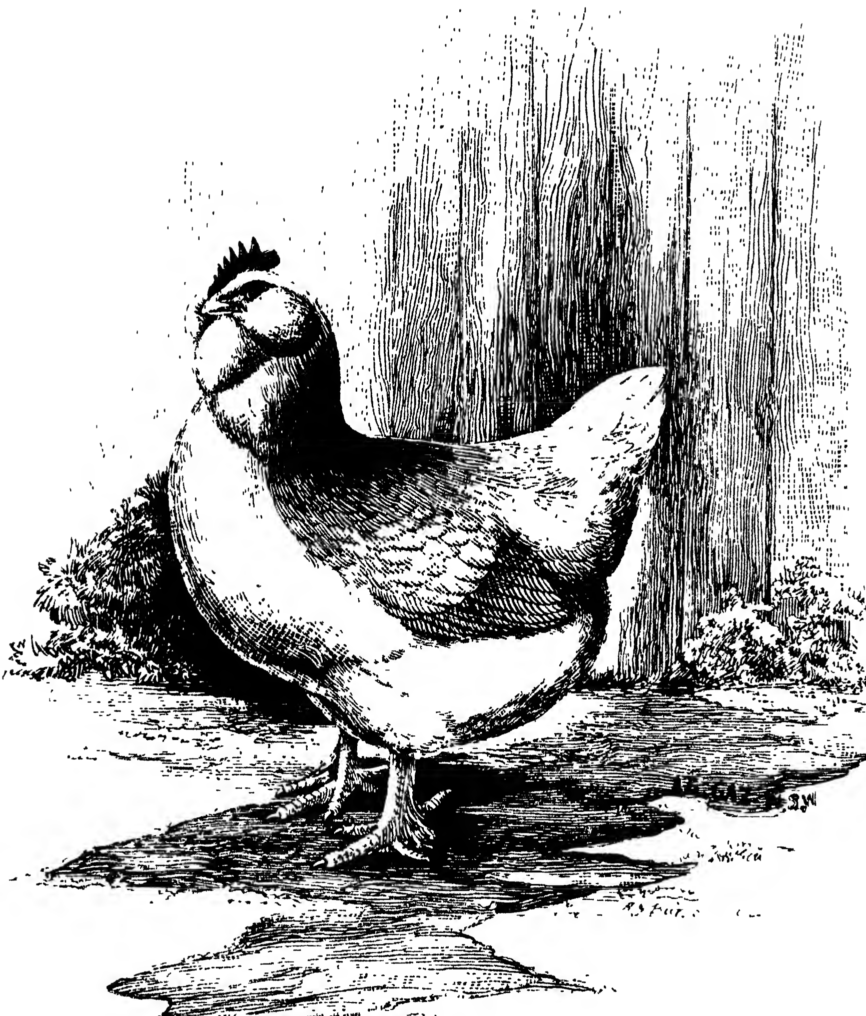
G. BRADSHAW.

CHAPTER XXXVII.

Faverolles as Layers.

FAVEROLLES having some Asiatic blood in them are sometimes referred to as good winter layers; however, my own experience of them is that just like other breeds, a good deal depends on the time they were hatched. Early hatched birds will lay early, while those late hatched rarely produce eggs till the following spring. With the infusion of Brahma and Cochin, writers on the breed usually put them down as fowls that go broody regularly. This is entirely a misconception, for in my own yards there is an English, a New Zealand, and a Victorian strain, and of sixteen laying hens last summer only three of them became broody, which, in my case, was a handicap, as broodies of other breeds had to be purchased.

So far as laying is concerned I have kept no records, but fortunately the breed has got a good test at the competition just over at the Hawkesbury College, the only test where they have yet appeared, and here again the date of hatching is an important one in relation to the first year's egg production. The six Faverolles, owned by Mr. Walsh, of Arcadia, were too young at the commencement of the competition in April, 1905, and at the end of two months had not laid an egg, thus commencing with a handicap of one-sixth duration of the test. In the entire 100 pens there were only five other lots with such leeway to make up, and, one excepted, all finished away far down in the programme. Not so with the Faverolles. Commencing in June with their first eggs, they crept up month by month, ultimately finishing in the thirty-fourth place amongst the hundred, beating a number of pens which had 150 eggs of a start. The Faverolles were laying strong at the finish, and the owner believes, that had the test continued a further two months, thus enabling the Faverolles to have an actual year's laying period, they would have been amongst the top few. From the time they started they crept up and passed from four to six lots monthly, until on the 31st March, they finished with 1,040 eggs, or 14½ dozen for each bird, weighing 25 oz. to the dozen, and had passed sixty-six pens on the way. Following is the monthly laying of the birds:—April 0, May 0, June 56, July 118, August 140, September 132, October 134, November 98, December 98, January 96, February 89, March 70. Coming to the financial results of the pen, such was also good, although having nothing to



FAVEROLLES HEN

show in the two dear months when eggs were from 1s. 6d. to 2s., the total value of the product, was just on 13s. for each hen, beating a number of the more popular and plentiful breeds and varieties. The above was certainly a splendid record, and although in most instances the performance of one pen does not prove much, still in the present case a good deal attaches to the figures, seeing that the competing pens are the direct progeny of the previous year's imported English stock, and prize winning birds at that. The breed is still in few hands here, and has not had time to deteriorate, consequently there cannot be any bad laying strains. My own stock are the result of crossing some Victorian birds with New Zealand and English, and although not tested, nor yet any records kept, I am satified, and the public may be, that those tested fairly represent the laying properties of the Faverolles in Australia. Mr. Walsh, encouraged with the success of his first venture with the breed, is competing with a second lot in the present 1906–7 College competition.

Concerning the laying properties of this breed in other States, Mr. H. May, of New Zealand, from whom I obtained some stock two years ago, wrote me that they were excellent performers in the way of laying, while Mrs. Travers, late of Gippsland, Victoria, from whom my first stock came four years ago, always championed the Faverolles as the best winter layers she ever had. However, private opinion, where no records are kept, is sometimes influenced in favour of the breed one patronises, and even when home tests are made, those in public are more readily accepted, consequently there is no need to go further for the actual performance of the French Dorking than the College records, which show that from a flock of pullets some eight or nine months old, there may reasonably be expected from each hen fourteen dozen eggs in the first laying period.

Chapter XXXVIII.

Faverolles in Australia.

Although it is only within the past year or two that Faverolles have become prominent in this State, the breed has been known in Australia for half-a-dozen years or more. Perhaps the first arrivals were from a well-known English breeder and judge—Mr. Hawker, who is interested in station property in South Australia. This gentleman on a visit here three years ago, when interviewed at the Royal Agricultural Show, spoke highly of the Faverolles, stating that he had forwarded a number of them to his station property in South Australia, a few years previous.

To Mrs. Travers was due the introduction of the breed to Victoria, her stock being exhibited, and well advertised, secured a number of patrons for them, but, as with most other new breeds, serious defects existed in a number of the stock, much of which has now been overcome. The principal trouble with the early importations was the want of the fifth toe. In the first few years after their introduction to England this was not insisted on, but when the Poultry Club took

the matter in hand such was embodied in the standard of perfection, with the result that the Faverolle cock or hen lacking this useless appendage is not eligible for a prize. Mrs. Travers exhibited a number of her birds in Sydney three years ago, and disposed of them to breeders here, but so many of the progeny came with but four toes that people tired of the strain. Prior to the above a medical gentleman of Sydney, now deceased, received some English importations, and although of better colour and larger than the Victorian birds, had not the extra foot embellishment.

Imported Faverolles Cock.

Sire of the twelve prize winners, Royal Agricultural Society's Show, 1906.

Then came some New Zealand birds from the yards of Mr. H. May, and these being the progeny of more recently imported English stock were of the correct colour and more in accordance with standard requirements. These and some later English importations, and a further New Zealand consignment to Mr. H. M. Hamilton constituted the bulk of the breeding stock of this State.

During the past year quite a number of the male birds were sold for crossing purposes, the experience so far being that the bulk of the

Faverolles Cockerel.

First prize, Royal Agricultural Society's Show, 1906. Seven months old; weight, 7¾ lb.

buyers purchased this breed more for commercial purposes than the show pen.

Reverting to the Victorian stock it may be mentioned that Mr. A. Masseran, of Victoria, visited England and France a few years ago, returning with a quantity of the Salmon and Black Faverolles. This gentleman being experienced in French methods, bred the birds for table purposes, and at the first time of exhibiting in the Victorian shows, won the bulk of the Government prizes offered for table poultry. Mr. Masseran's success in this branch of the poultry business, secured for him the contract for the supply of the Governor-General's table poultry, Faverolles forming a large portion of the supply.

Faverolles Cockerel.

Five months old; weight, 6 lb.

The writer's experience with this breed has been exceptionally good. Each year sixty or seventy were hatched, and, except through accident, all were reared. It is, however, in the matter of growth that they excel many other varieties. If plenty of food is supplied they grow all the time; and, whether attributable to strain or the general character of the breed, they certainly beat most sorts in putting on flesh and weight.

The illustrations will show the weights at various ages, which are extraordinarily good, but it is in the beautiful quality of the meat that the most merit lies. The appetising appearance of the trussed birds, and the delicate flavour, being all that connoisseurs could desire.

As has been said in the April *Gazette*, there are other colours of Faverolles, namely, Ermines, and Black. Of the latter, Mr. Masseran has been the only imported, one pair of this stock being now in the writer's yards; but of whatever colour, all have the same economic qualities, even the crosses from them possessing good meat quality.

Faverolles Cockerel.

Three months old, weight, 3¼ lb.

In connection with crossing, the following reply to a correspondent in a late issue of the English *Feathered World* will be of interest:—"Faverolles chickens are excellent birds, and are very hardy. I have seen really tip-top table birds bred from a Faverolles cock and Buff Orpington hens; the chickens were nearly all white, with just a few striped feathers in the hackle. At four and a half months' old they were a rare size, and the flesh was beautifully white and of good texture. Being a white-plumaged bird, they trussed remarkably well for the market."

It will be remembered that Mr. H. Cadell exhibited several of the above cross at the 1905 Royal Show in the table poultry classes, the colour being, as stated above, almost white, and the carcases were of large size, and covered with a great quantity of white meat.

Pen of Faverolles Pullets.

Enough has now been shown as to the merits of the Faverolles for commercial purposes, while as exhibition birds they should command a good deal of attention from the fact that very little trouble is

Faverolles Cockerels at Home.

necessary with them for the show pen, neither washing, grooming, or trimming being required. The fine show which appeared at this year's Royal Agricultural Exhibition were just lifted out of their runs and taken to the show.

Appended is the standard for judging Faverolles :—

General characteristics of the cock :—

Head and neck.—Head, broad, flat, and short, free from crest. Beak, stout and short. Comb, upright, single, medium size, four to six neat serrations, free from coarseness or any side work. Ear-lobes, small, hidden by muffing. Wattles, small, fine in texture. Beard and muffing, full, but the beard should be short. Neck, short and thick, especially near the body, into which it should be well let in.

Body.—Body, thick, deep, and cloddy. Breast, broad, keel-bone very deep and coming well forward in front, but not too rounded. Back, flat, square, very broad across the shoulders and saddle, and of fair length, but not so long as in the hen. Sides, deep. Wings, prominent in front, but small and carried closely tucked to body.

Tail.—Carried rather upright, feathers and sickles stout and medium length ; long thin flowing tail feathers, carried low or straight, are very objectionable.

Legs and feet.—Thighs, short, wide apart, plenty of body between them. Shanks, medium length, and stout, straight, sparsely feathered down to outer toe. Knees straight ; carried well apart ; narrowness or tendency to be in-kneed very objectionable.

Toes.—Five in number, the fifth toe clearly divided from the fourth toe, outer toe sparsely feathered.

General shape and carriage.—Active and alert.

Size and weight.—Large cocks, 7 lb. to 8½ lb. ; cockerels, 6½ lb. to 7½ lb.

General characteristics of hen :—

Head and neck.—Head, beak, ear-lobes, wattles, beard, and muffing, as in the cock.

Comb.—Similar to the cock, but much smaller and very neat, and fine in texture.

Neck.—Short and full, carried straighter than in the cock.

Body.—Generally longer and deeper than in the cock

Breast.—Deep, full and prominent, keel-bone longer than in the cock.

Back.—Broad and flat, longer than in the cock.

Tail.—Fan-shaped, feathers broad, stout, and medium length, carried midway between upright and drooping.

Legs and feet.—As in the cock.

General shape and carriage.—Active and alert.

Size and weight.—Large hens, 6 lb. to 7 lb. ; pullets, 5 lb. to 6½ lb.

Colour in Salmon Faverolles :—

In both sexes :

Beak.—Horn or white.

Eye.—Grey or hazel.

Comb.—Red.

Face, ear, lobes, and wattles.—Red, both partially concealed by muffing.

Shanks and feet.—White.

In the cock :

Beard and muffing.—Black, ticked with white.

Hackles.—Straw.

Back and shoulders.—A mixture of black, white, and brown

Breast.—Black.

Wing bows.—Straw colour.

Wing bar.—Black.

Secondaries.—Pure white on the outer edge of feathers and black on the inner edge and tips.

Primaries.—Black.

Thighs and underfluff.—Black.

Tail.—Black.

In the hen :

Beard and muffing.—Creamy white.

Head and neck hackle.—Wheaten brown, striped with same colour of darker shade.

Back and shoulders.—Wheaten brown.

Wings.—Similar to back, but the colours are softer and lighter.

Primaries and secondaries.—Wheaten brown.

Breast, thighs, and fluff.—Cream.

Tail.—Wheaten brown.

Value of points in Faverolles—Cock or Hen.

Defects.	Deduct up to.
Bad comb	10
Insufficient beard or muffing	20
Defective colour	25
Want of symmetry	20
,, size	15
,, condition	10
A perfect bird to count	100

Serious defects for which birds should be passed :—

Skin and legs other than white; absence of all beard or muffing.

This now completes the articles on "Farmers' Fowls." A few miscellaneous sorts have not been included, but those desiring the best sorts will find one or all of those dealt with admirably suited for whatever purpose or requirement.

The next chapters will deal with other subjects in connection with the profitable care and management of poultry.

(*To be continued.*)

Report from the Commercial Agent.

The Minister for Mines and Agriculture received a cablegram on the 21st March, 1906, from Mr. Valder, the Government Commercial Agent for this State in South Africa, reporting that the Colony of Natal had decided to reimpose the duty on wheat and flour. The decision to be acted upon at once.

Irrigation.

United States National Scheme.

In order that some idea of the vastness of this National Scheme, and that the article which follows may be read with a better conception of what this latest phase of Irrigation Enterprise means, a portion of an article from *Maxwell's Talisman* is given.

Progress of Work under the Reclamation Act—Projects Approved and Under Construction.

The passage and approval of the National Irrigation Act nearly three years ago inaugurated a broad, comprehensive national policy of internal expansion, and marked the beginning of a new era in western development and home-making. The work of reclaiming the deserts, and transforming them from barren desolate wastes into productive fields and populous, prosperous rural settlements, by means of storage reservoirs and irrigation canals, was understood to be no small undertaking; it necessarily required a great deal of preliminary work and the expenditure of large sums of money; but the officers and engineers of the Government Service at once set about the task of carrying into practical operation the provisions of the irrigation law. There are those who have been disposed to criticise the Reclamation Service because the work of actual construction on certain projects has not commenced sooner; but when the people consider the vast amount of necessary preliminary work, the various problems to be solved in connection with the several projects, the private interests to be harmonised, &c., all will concede that the progress made has been both rapid and satisfactory. Careful estimates and complete plans must be made for such vast projects as are outlined in the work undertaken by the national government under the Reclamation Act. Hasty, haphazard work in the beginning would not only have put the government experts and engineers in bad light, but would have resulted disastrously, and relegated the whole plan of national irrigation in the line of a public failure, to be condemned by the people as a scheme of public graft or the impracticable proposition of visionary "rainbow chasers." Fortunate for the policy of national irrigation, fortunate for this and future generations of our country, that the United States Geological Survey, into whose hands the carrying into operation of the law was placed, was composed of practical, experienced scientific men, who were able to at once grapple with the problems involved in so vast a work as that outlined by the Reclamation Act. The dams and canals the government is planning are not merely temporary affairs of earthern embankments across watercourses, or small

ditches to carry a limited amount of water; but massive structures of rock and concrete that will, like walls of solid granite, endure for all time, together with great canals that will convey water for the irrigation of millions of acres of land, and constructed with a view to permanency and perfection.

The Reclamation Fund.

The Reclamation fund, derived from the sale of public lands in the arid States, has grown very rapidly. During the first year after the passage of the Reclamation Act about $4,000,000 were turned into the Treasury. The amount of money due the fund is now nearly $25,000,000. On the first of July, 1904, $23,000,000 had been covered into the fund, and at the rate of land sales for 1904 the amount covered in by July 1, 1905, will be approximately $26,000,000.

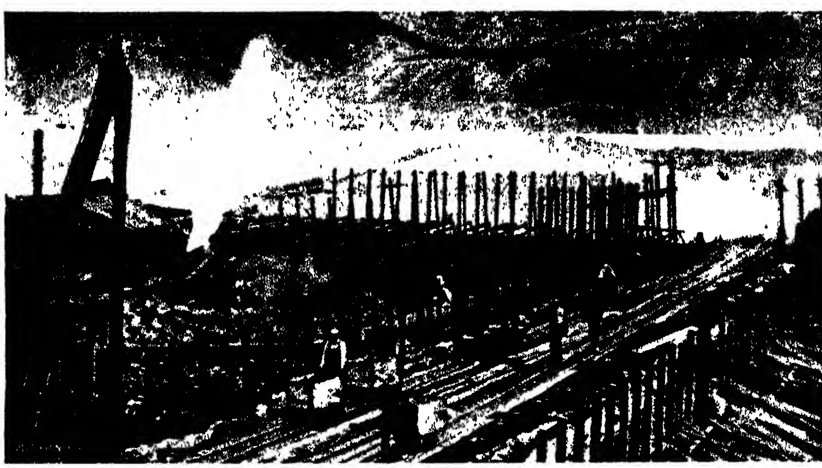
The following table shows the projects upon which surveys and estimates have been completed and approved. Construction work is well under way on several of these:—

State.	Project.	Acreage.	Cost.	Cost per Acre.
Arizona	Salt River	160,000	$ 3,200,000	$20
California	Yuma	85,000	2,975,000	35
Colorado	Uncompahgre	100,000	2,500,000	25
Idaho	Minidoka	70,000	1,820,000	26
Montana	Huntley	40,000	1,200,000	30
	Ft. Buford (½)	30,000	900,000	30
Nebraska	North Platte	100,000	3,500,000	35
Nevada	Truckee-Carson	100,000	2,600,000	26
New Mexico	Hondo	10,000	280,000	28
North Dakato	Ft. Buford (½)	30,000	900,000	30
Oregon	Pumping	31,000	550,000	18
	Malheur	75,000	2,250,000	30
South Dakato	Bellefourche	60,000	1,920,000	32
California-Oregon	Palouse	80,000	2,800,000	35
Washington	Shoshone	160,000	4,000,000	25
Wyoming	Klamath	300,000	5,000,000	17
	Totals	1,431,000	$36,395,000	

A Re-Conquest of Nevada.

GUY ELLIOTT MITCHELL.

Has Nevada always been an arid and desert region? Its geological records, as indelibly carved in sandstone and granite, showing the shore lines of ancient lakes, proclaim that it has not, but that at one time a vast body of water, as great in area as Lake Erie, covered a portion of the State. To-day, however, the aridity of the country is unquestioned and the 350,000 acres, to part of which Uncle Sam is about to apply water, will practically double its well-irrigated area and its agricultural population.



Building Intake Works just above Main Division Dam, Truckee River, Nevada.

Nevada's ancient inland sea is known as Lake La Hontan; it was one of several great prehistoric lakes distributed over the Great Basin of the arid region, among them Lake Bonneville, of which the Great Salt Lake was the deepest portion. Its area was nine times greater than the Great Salt, or almost as large as Lake Michigan, and much deeper

The contracted remains of Lake La Hontan in Nevada are found in Pyramid Lake and a number of other small enclosed lakes which were the deepest portions of the ancient lake. Since these large prehistoric lakes were landlocked and did not overflow, it follows that the rainfall which fed them was much heavier than it is to-day.

Drowning out the Mormons.

Should conditions revert, many of the important points situated in the Great Basin would be hopelessly flooded, such, for instance, as the Mormon

Temple, which would stand in 850 feet of water, while 700 miles of railroad would be submerged.

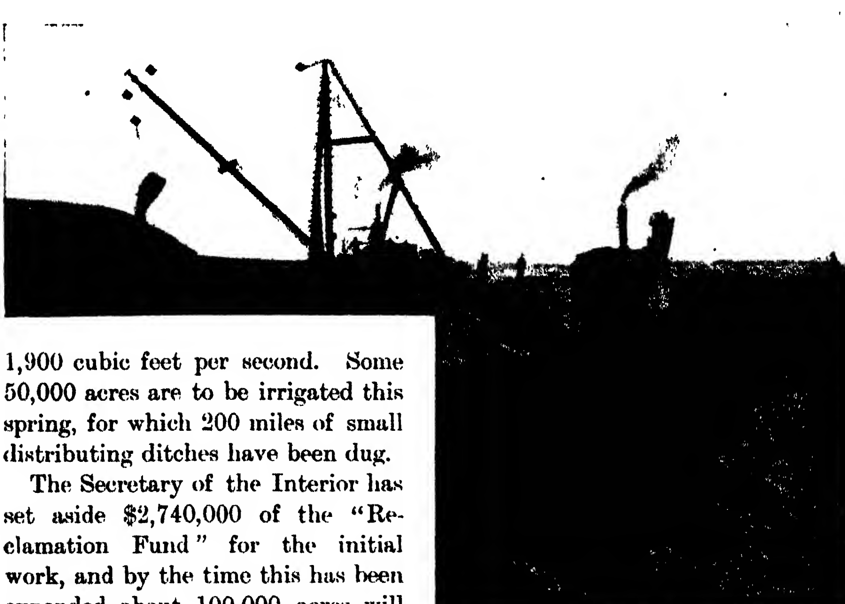
These prehistoric lakes are said to be of very recent origin—that is, recent by the geologists' count—perhaps 30,000 or 40,000 years old. Fossils have been found showing the presence of primitive man along their ancient

A Cemented Section on the Main Truckee Canal.

shores and embankments, which, in many instances, are as perfect in contour and as distinct as if the waters had receded only a few years since. These lakes included such arid and fear-inspiring localities of to-day as the Black Rock Desert, Skull Valley, Death Valley, and a score of other places where the bleached bones of man and animal attest to the awful lack of water.

Great Government Irrigation Work.

This first irrigation work of the National Government, which is to be celebrated by the turning of the water into the gigantic ditches this month, is the largest project which has been definitely outlined and approved under the Irrigation Act—known as the Truckee-Carson project. When completed it will involve the expenditure of approximately nine million dollars and will reclaim 350,000 acres of desert land. That portion of the system now completed consists of a canal 31 miles long to take water from the Truckee River and convey it to the Carson River, where a large storage reservoir is projected. Just below this reservoir site, the waters of the two streams will be led out upon the plains by two canals, with a combined capacity of 1,900 cubic feet per second. Some 50,000 acres are to be irrigated this spring, for which 200 miles of small distributing ditches have been dug.



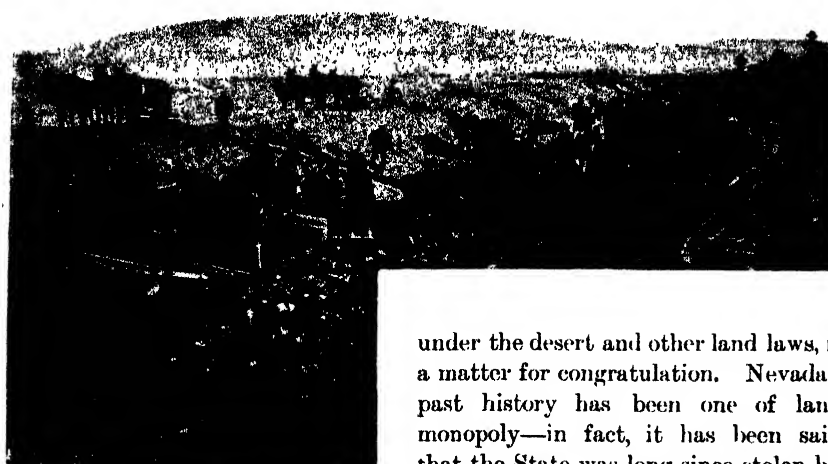
A Steam Shovel working in one of the large cuts in Main Truckee Canal.

The Secretary of the Interior has set aside $2,740,000 of the "Reclamation Fund" for the initial work, and by the time this has been expended about 100,000 acres will be under canals, and the settlers will be returning in annual payments the original investment. The money thus received will be used as a revolving fund for the completion of this project. The land has been divided into farm units of 80 acres, and the cost of reclamation will be $26 per acre. Work is being commenced this spring on regulating gates at the outlet of Lake Tahoe, located in California, but whose waters will be used to reclaim the fertile Nevada soil. Future plans involve the draining of Carson Sink, 25,000 acres in extent, which overflows in years of heavy rainfall, and the reclamation of lands in the upper Truckee and Carson Valleys. As these large areas are gradually brought under irrigation, a greater water supply will be required and nine additional reservoirs will be constructed, with a combined storage capacity of over a million and a quarter acres feet (an acre foot equals 1 acre, 1 foot deep).

Fruits, Vegetables, and Grains yield abundantly.

The soil under this project is very fertile, and deciduous fruits, such as apples, pears, peaches, grapes, all the berries and vegetables, produce luxuriantly. Wheat, oats, potatoes, and alfalfa (lucerne) are the staple crops. The lands are tributary to the Southern Pacific, the Nevada, California, and Oregon, and the Virginia and Truckee railroads, and the recent enormous activity in gold and silver mining in Nevada insures a near and profitable market. At the same time the supply of food products will greatly reduce the cost of living and further stimulate mining development.

The fact that a very large portion of the lands included in this project belong to the Government and have been withdrawn from speculative entry



Scrapers, or Scoops, at work on Main Truckee-Carson Canal, Nevada.

under the desert and other land laws, is a matter for congratulation. Nevada's past history has been one of land monopoly—in fact, it has been said that the State was long since stolen by land-grabbers. In area Nevada is three times the size of Indiana, but her population is scarcely sufficient for a single small county. The popular vote of last year was but a little over 12,000. The bulk of the inhabitable lands are in the hands of a few great land-owners, while the opportunity for settlement and increased population has never been extensive. Nevada's land history is one which can be studied with profit by those who are searching for light on the question of proper administration of the public domain. With exception of the influx of immigration due to mining excitement, the population is at a standstill and must continne to remain so until farm lands are thrown open to settlement in small tracts through Government irrigation.

Stealing away the State.

When the State was admitted to the Union, in place of receiving the usual donation of alternate school sections—sixteen and thirty-two in each township—she secured a flat grant from the Government of two million acres of public land, to be located wherever her lawmakers saw fit. The State Legislature passed as much as desired of this great and valuable resource into private ownership of stockmen, at as low a figure as 25 cents an acre. These lands have been located up and down the sides of every river and stream and around every spring and waterhole in the State, so that while Nevada has to-day some sixty million acres of public land, there is not a quarter section of it upon which a homesteader could make a living. The land granted to the State for school purposes—disposed of by the State for a mess of pottage—controls the lands of the State.

The Government's irrigation, when worked out, will immediately double Nevada's population; it will provide a new life-blood of settlement and citizenship for a region of unsurpassed agriculture.

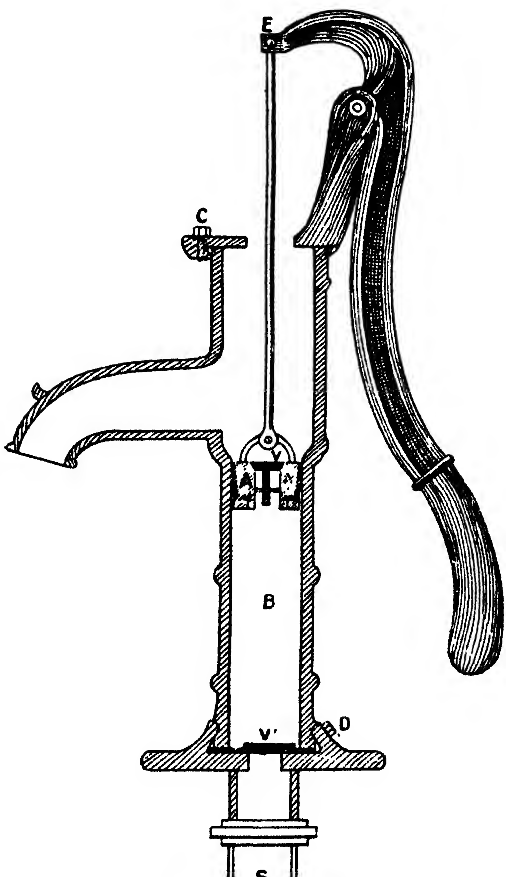
This great reclamation scheme for the rebuilding of Nevada is being carried into operation by Engineer L. H. Taylor, under the supervision of Frederick H. Newell, Chief Engineer of the Reclamation Service. It will afford the first practical example of the operations of the new national irrigation law.

The illustrations are from photographs kindly forwarded by Mr. Mitchell from Washington, D.C.

The Common Pump.—How to Repair.

F. G. CHOMLEY.

It is within the experience of most people who live in the country to have, at various times and places, gone to the pump in the yard for the purpose of getting water, and after vainly endeavouring to raise water by violent and rapid working, and having coaxed the machine with water spilt from a jam tin down the barrel, to have resorted to the ancient but reliable method of rope and bucket. Why so many pumps are in this state of repair, when, in the majority of cases, they can be made as good as new with little trouble, seems unaccountable.

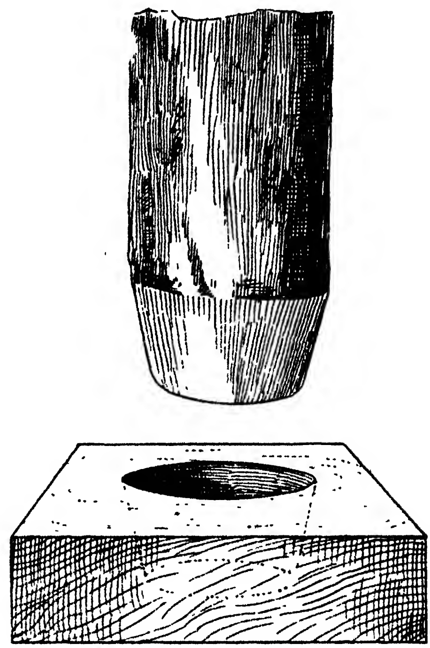


Section of Common Pump.

If the pump is not fixed at a greater height than 20 feet above the water, an ordinary common suction-pump will work, provided the suction-pipe does not draw air, the two valves hold, and the cup-leather on the piston or plunger is not perished and is a good fit.

Theoretically, a pump will work up to a suction lift of about 34 feet; but practically they will not. To work at this lift would mean every joint and valve being an accurate fit, a condition not likely to exist outside a scientific laboratory. Looking at the section of a suction lift-pump, it will be seen that there are two valves, V and V_{II}, both opening upwards. V is usually a brass cone valve, working in the piston or plunger;

V_1 is generally of leather, while at A is the cup-leather. If the valve V_1 is watertight, water poured into the pump barrel will remain there; if not, it is known at once that this valve is perished. If it holds, and when the plunger is worked up and down without raising water, then either the valve V or the cup-leather A is at fault. Sometimes there is a leak in the suction-pipe, or perhaps the end F is out of water. This should be looked to before taking the pump to pieces.

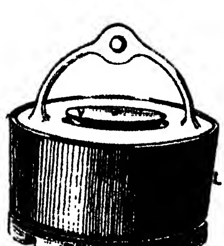


Plug and Ring to make Cup-Leather.

To remove the plunger, take off the nuts at E and C, remove handle at top, then the plunger can be drawn out and examined.

To get at V_1, the nut D should be taken off, and the barrel can be detached from the flange. In some make of pumps the barrel is screwed to the flange. Should these nuts, &c., be rusted, a little kerosene applied to a piece of rag, and left on them for some time, and then given a few taps with a hammer, will generally loosen them. Be careful not to use too much force unscrewing or the stud or nut may be damaged.

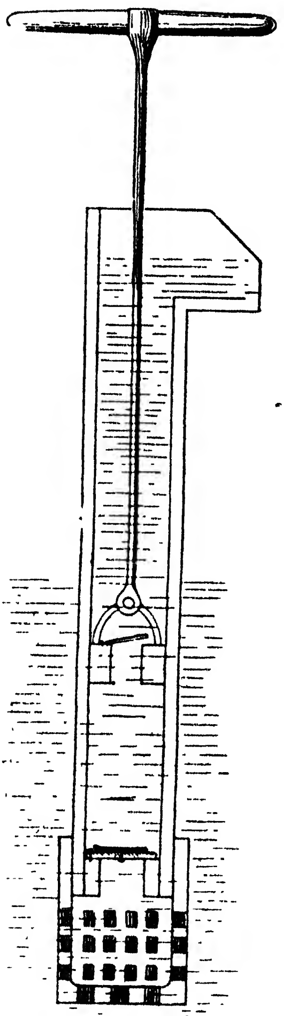
Cup-Leather.



Pistor or Plunger with cup-leather in position.

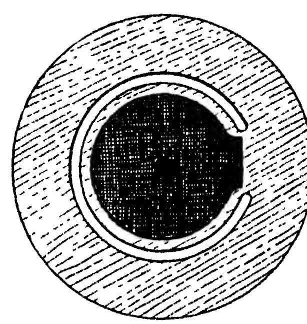
To renew the cup-leather, take a piece of good leather and thoroughly soak it in water till quite pliable. Meanwhile, make a ring of iron, or a hole can be worked in a plank of hardwood, as shown in the illustration, the same size as the pump barrel. A tapering plug somewhat less in diameter than the ring is also made. The leather, having a small hole punched in the centre, is placed on the ring hair side up (this will bring the flesh or rough side next the barrel of the pump when at work); the plug is then forced down with a lever, pushing the leather into the ring, and left to set. When dry, clean up with a very sharp knife. This cup-leather is fitted to the plunger by removing the ring (marked R) which is screwed on to the plunger, adjusting the leather, and screwing the ring back again. See that the valve V is a good fit; if a brass cone valve it will generally be found in fair order.

Should the valve V_1 require renewing, cut a sheet of leather the same shape as the old one, or, if the old one is missing, of the shape shown, but of size to fit the pump. This kind of valve is generally called a clack-valve. Put the leather hair side up, bringing the flesh side against the valve-seat, give the valves and cup-leather a good oiling, and put the barrel on, screw up tight; replace plunger and top, and screw up. The pump should now be as good as new. Cup-leathers may be purchased at vendors of this class of goods, of any size: but once a ring is made, cup-leathers are quite easy to make, and there is not the delay that might be caused by sending to the town for one.



A simple cheap Lift Pump.

It frequently happens that a cheap rough pump is required to drain a waterhole for



Clack Valve.

cleansing or pumping liquid manure. The illustration is self-explanatory: The barrel could be made of heavy galvanised down-spout, or, as shown in the illustration, of boards; the plunger would then be square, a piece of leather tacked round it to make it hold water, a clack-valve being placed in the middle as shown, with another at the bottom; these should be of stout leather, with wood weights, to make them fall on their seats and keep them flat. A rough strainer is an advantage, placed at the lower end to keep rubbish out of the barrel. Of course, a pump like this is not very efficient, as the plunger cannot be made a very accurate fit, but for a low lift it will give satisfaction. It is worked by pulling on the crosspiece which serves as a handle. This pattern is, with slight modification in the plunger, known as a spearhead-pump.

Diseases of the Horse.

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WOUNDS AND THEIR TREATMENT.

Description of Wounds.

A WOUND is an injury to any part of the body, involving a solution of continuity or disruption of the affected parts, and is caused by violence, with or without laceration of the skin. In accordance with this definition, we have the following varieties of wounds: Incised, punctured, contused, lacerated, gunshot, and poisoned. They may further be classified as superficial, deep, or penetrating, and also as unclean, if hair, dirt, or splinters of wood are present; as infected, when contaminated with germs; and as a septic, if the wound does not contain germs.

An incised wound is a simple cut made with a sharp body, like a knife, producing merely a division of the tissues. The duller the body, the more force is required, the more tissues destroyed, and a greater time will be required for healing. In a cut wound the edges are even and definite, while those of a lacerated wound are irregular and torn. Three conditions are present as the result of an incised wound; (1) Pain, (2) hemorrhage, (3) gaping of the wound. The first pain is due to the crushing and tearing of the nerve fibres. In using a sharp knife and by cutting quickly, the animal suffers less pain and healing occurs more rapidly. The secondary pain is usually due to the action of the air and inflammatory processes. When air is kept from the wound pain ceases soon after the lesion is produced. Hemorrhage is absent only in wounds of nonvascular tissues, as the cornea of the eye, the cartilage of joints, and other similar structures. Bleeding may be from the arteries, veins, or capillaries. In the latter form of bleeding the blood oozes from the part in drops. Hemorrhage from the veins is dark red and issues in a steady stream without spurting. In arterial bleeding the blood is bright red and spurts with each heart beat. This latter variety of hemorrhage is the most dangerous, and should be stopped at once before attempting any further treatment. Bleeding from small veins and capillaries ceases in a short time spontaneously, while larger vessels, especially arteries, require some form of treatment to cause complete stoppage of the hemorrhage.

Hemostasia.

By this term is meant the checking of the flow of blood. It may be accomplished by several methods, such as compress bandages, torsion, hot iron, and ligatures. The heat from a hot iron will cause the immediate clotting of the blood in the vessels, and this clot is further supported by the production of a scab, or crust, over the portion seared. The iron should be at a red heat. If at a white heat the tissue is charred, which makes it brittle and the bleeding is apt to be renewed. If the iron is at a black heat the tissue will stick to the iron and will pull away from the surface of the wound. Cold water and ice bags quickly stop capillary bleeding, while hot water is preferable in more excessive hemorrhages. Some drugs, called styptics, possess the power of contracting the walls of blood vessels and also of clotting the blood. A solution of the chloride of iron placed on a wound alone or by means of cotton drenched in the liquid produces a rapid and hard clot. Tannic acid, alum, acetic acid, alcohol, and oil of turpentine are all more or less active in this respect. To check bleeding from large vessels compression may be adopted. When it is rapid and dangerous and from an artery, the fingers may be used for pressing between the wound and the heart (digital compression), but if from a vein, the pressure should be exerted on the other side of the wound. Tourniquet may also be used by passing a strap around the part and tightening after placing a pad over the hemorrhage. The rubber ligature has now replaced the tourniquet, and is bound tightly around the limb to arrest the bleeding. Tampons, such as cotton, tow, or oakum, may be packed tightly in the wound and then sewed up. After remaining there for twenty-four or forty-eight hours they are removed. Bleeding may sometimes be easily checked by passing a pin under the vessel and by taking a horse hair and forming a figure 8 by running above and below the pin, thus causing pressure on the vessel. Torsion is the twisting of the blood vessel until the walls come together and form a barrier to the flow of blood. It may be accomplished by the fingers, forceps, or by running a pin through the vessel, turning it several times, and then running the point into the tissue to keep it in a fixed position.

Ligation is the third method for stopping a hemorrhage. Seize the blood vessel with the artery forceps, pass a clean thread of silk around it, and tie about ½ inch from its end. The silk should be sterilised by placing it in an antiseptic solution so as not to impede the healing process or cause blood poisoning or lockjaw, which often follows the ligation of a vein with unsterilised material. Sometimes it will be impossible to reach the bleeding vessel, so it is necessary to pass the ligature around a mass of tissue which includes the blood vessel. Ligation is the most useful method of arresting hemorrhage, since it disturbs healing least and gives the greatest security against secondary hemorrhage.

Sutures.

After the bleeding has been controlled and all foreign bodies removed from the wound, the gaping of the wound is noticeable. It is caused by the contraction of the muscles and elastic fibres, and its degree depends on the extent, direction, and nature of the cut. This gaping will hinder the healing process, so that it must be overcome by bringing the edges together by some sort of sutures or pins, or by a bandage applied from below upwards. As suture material, ordinary cotton thread is good if well sterilised, as is also horse hair, cat-gut, silk, and various kinds of wire. If the suture is made too tight, the subsequent swelling may cause the stitch to tear out. In order to make a firm suture the depth of the stitch should be the same as the distance the stitch is from the edge of the wound. The deeper the suture the more tissue is embraced and the fewer the number of stitches required. In tying a suture use the square or reef knot. Closure of wounds by means of adhesive plaster, collodion, and metal clamps is not practiced to any great extent in veterinary practice.

Process of Healing.

In those cases where perfect stoppage of bleeding, perfect coaptation of the edges of the wound, and perfect cleanliness are obtained, healing occurs within three days, without the formation of granulations, pus, or proud flesh, by what is termed *first intention*. If wounds do not heal in this manner they will gap somewhat, and become warm and painful. Healing then occurs by granulation or suppuration, which is termed healing by *second intention*. The sides of the wound become covered with granulation tissue, which may fill the wound and sometimes overlap the lips, forming a fungoid growth, called proud flesh. Under favourable conditions the edges of the wound appear to grow together by the end of the first week, and the whole surface gradually becomes dry, and finally covered with pigmented skin, when the wound is healed. The cause of pus formation in wounds is usually due to the presence of germs. For this reason the utmost care should be adopted to keep clean wounds aseptic, or free from germs, and to make unclean wounds antiseptic by using antiseptic fluids to kill the microbes present in the wound. The less the injurious action of this fluid on the wound, and the greater its power to kill germs, the more valuable it becomes. All antiseptics are not equally destructive, and some germs are more susceptible to one antiseptic than to another. The most important are (1) bichloride of mercury, which is to be preferred on horses. It becomes weakened in its action if placed in a wooden pail or on an oily or greasy surface. It is used in the strength of 1 part of bichloride to 1,000 to 5,000 parts of water, according to the delicacy of the tissue to which it is applied. (2) Carbolic acid, in from 2 to 5 per cent. solution is used on infected wounds and for cleaning instruments, dressings, and sponges. It unites well with oil, and is preferred to the bichloride of mercury on a greasy surface. A 5 per cent.

solution in oil is often used under the name of carbolised oil. (3) Aluminum acetate is an efficient and cheap antiseptic, and is composed of 1 part alum and 5 parts acetate of lead, mixed in 20 parts of water. (4) Boracic acid is good in a 2 to 4 per cent. solution to cleanse wounds and wash eyes. Creolin and lysol may be used in a 2 to 5 per cent. solution in water. Iodoform is one of the most used of the antiseptics, and it also acts as an anodyne, stimulates granulation, and checks wound secretion. A very efficacious and inexpensive powder is made by taking 5 parts of iodoform and 95 parts of sugar, making what is called iodoform sugar. Tannic acid is a useful drug in the treatment of wounds, in that it arrests hemorrhage, checks secretion, and favours the formation of a scab. A mixture of 1 part tannic acid and 3 parts iodoform is good in suppurating wounds. Iodol, white sugar, ground and roasted coffee, and powdered charcoal, are all used as protectives and absorbents on suppurating surfaces. More depends on the care and the method of application of the drug than on the drug itself. On aseptic wounds use only those antiseptics that do not irritate the tissue. If care is used in the application of the antiseptic, corrosive sublimate or carbolic acid is to be recommended, but in the hands of irresponsible parties lysol or creolin is safer. In order to keep air from the wound and to absorb all wound secretions rapidly, a dressing should be applied. If the wound is aseptic, the dressing should be likewise, such as cotton gauze, sterile cotton, oakum, or tow. This dressing should be applied with uniform pressure at all times, and secured by a bandage. Allow it to remain for a week or ten days if the wound is aseptic, or if the dressing does not become loose or misplaced or become drenched with secretions from the wound, or if pain, fever, or loss of appetite does not develop. The dressing should then be removed, the wound treated antiseptically, and a sterilised dressing applied.

Healing under a Scab.

This often occurs in small superficial wounds that have been kept aseptic. In order for a scab to form, the wound must not gap, secrete freely, or become infected with germs. The formation of scab is favoured by astringents and styptics, such as tannic acid, iodoform, and 5 per cent. solution of zinc chloride. In case of large hollow wounds that cannot be dressed, such as fistulous withers, open joints, &c., antisepsis may be obtained by warm-water irrigation with or without an antiseptic fluid. It should continue day and night, and never be interrupted for more than eight hours, for germs will then have gained headway and will be difficult to remove. Four or five days of irrigation will be sufficient, for granulations will then have formed and pus will remain on the outside if it forms. For permanent irrigation the stream should be very small, or drop by drop, but should play over the entire surface of the wound. It is always better to heal an infected wound under a scab, or treat it as an open wound, than it is to suture the wound, thus favouring the growth

of the enclosed germs and retarding ultimate healing. In the latter case pus may develop in the wound, form pockets by sinking into the tissues, and cause various complications. Such pockets should be well drained, either through incisions at the bottom or by drainage tubes or setons. They should then be frequently syringed out or continuously irrigated. In case proud flesh appears, it should be kept down either by pressure or by caustics, as powdered bluestone, silver nitrate, chloride of antimony, or by astringents, such as burnt alum. If they prove resistant to this treatment, they may be removed by scissors or the knife, or by searing with the hot iron. The following rules for the treatment of wounds should be followed :—(1) See that the wound is clean, removing all foreign bodies. (2) For this purpose use a clean finger rather than a probe. (3) Arrest all hemorrhage before closing the wound. (4) Antiseptics should only be used if you suspect the wound to be infected. (5) When pus is present, treat without closing the wound. (6) This may be accomplished by draining tubes, absorbent dressings, setons, or continuous irrigations. (7) Protect the wound against infection while healing.

Lacerated and Contused Wounds.

Lacerated and contused wounds may be described together, although there is, of course, this difference, that in contused wounds there is no break or laceration of the skin. Lacerated wounds, however, are, as a rule, also contused—the surrounding tissues are bruised to a greater or lesser extent. While such wounds may not appear at first sight to be as serious as incised wounds, they are commonly very much more so. Lacerations and contusions, when extensive, are always to be regarded as dangerous. Many horses die from septic infection or mortification as a result of these injuries. We find in severe contusions an infiltration of blood into the surrounding tissues; disorganisation and mortification follow, and involve often the deeper seated structures. Abscesses, single or multiple, may also result, and call for special treatment.

In wounds that are lacerated the amount of hemorrhage is mostly inconsiderable; even very large blood vessels may be torn apart without inducing fatal result. The edges of the wound are ragged and uneven. These wounds are produced by barbed wire or some blunt object, as where a horse runs against fences, board piles, the corners of buildings, or where he is struck by the pole or shafts of another team, falling on rough irregular stones, &c.

Contused wounds are caused by blunt instruments moving with sufficient velocity to bruise and crush the tissues, as running against objects, kicks, or falling on large, hard masses.

Treatment.

In lacerated wounds great care must at first be exercised in examining or probing to the very bottom of the rent or tear, to see if any foreign body be present. Very often splinters of wood or bits of stone or dirt

are thus lodged, and unless removed prevent the wound from healing; or if it should heal the wound soon opens again, discharging a thin, gluey matter that is characteristic of the presence of some object in the parts. After a thorough exploration, these wounds are to be carefully and patiently fomented with warm water, to which has been added carbolic acid in the proportion of 1 part to 100 of water. Rarely, if ever, are stitches to be inserted in lacerated wounds. The surrounding tissues and skin are so weakened in vitality and structure by the contusions that stitches will not hold; they only irritate the parts. It is better to endeavour to secure coaptation by means of bandages, plasters, or collodion. One essential in the treatment of lacerated wounds is to secure a free exit for the pus. If the orifice of the wound is too high, or if the pus is found to be burrowing in the tissues beneath the opening, we must then make a counter opening as low as possible. This will admit of the wound being thoroughly washed out, at first with warm water, and afterwards injected with some mild astringent and antiseptic wash, as chloride of zinc, 1 drachm to a pint of water. A dependant opening must be maintained until the wound ceases to discharge. Repeated hot fomentations over the region of lacerated wounds afford much relief and should be persisted in.

Bruises.

Bruises are nothing but contused wounds, where the skin has not been ruptured. There is often considerable solution of continuity of the parts under the skin, subcutaneous hemorrhage, &c., which may result in local death (mortification) and slough of the bruised parts. If the bruise or contusion is not so severe, many cases are quickly cured by constant fomentation with hot water for from two to four hours. The water should be allowed about this time to *gradually* become cool and then cold. Cold fomentation must then be kept up for another hour or two. Dry the parts thoroughly and quickly, and bathe them freely with camphor 1 ounce, sweet oil 8 ounces, or with equal parts of lead-water and laudanum. A dry, light bandage should then be applied, the horse allowed to rest, and, if necessary, the treatment may be repeated each day for two or three days. If, however, the wound is so severe that sloughing must ensue, we should encourage this by poultices made of linseed meal, wheat-bran, turnips, onions, bread and milk, or hops. Charcoal is to be sprinkled over the surface when the wound is bad smelling. After the slough has fallen off the wound is to be dressed with warm antiseptic washes of carbolic acid, chloride of zinc, permanganate of potash, &c. If granulating (filling up) too fast, use burnt alum or air-slacked lime. Besides this local treatment, we find that the constitutional symptoms of fever and inflammation call for measures to prevent or control them. This is best done by placing the injured animal on soft or green food. A physic of Barbados aloes, 1 ounce, should be given as soon as possible after the accident. Sedatives, such as tincture of aconite root, 15 drops three times a day, or ounce doses of saltpetre every four hours, may also

be administered. When the symptoms of fever are abated, and if the discharges from the wound are abundant, the strength of the patient must be supported by good food and tonics. One of the best tonics is as follows:—Powdered sulphate of iron, powdered gentian, and powdered ginger, of each 4 ounces. Mix thoroughly and give a heaping tablespoonful twice a day, on the feed or as a drench.

Punctured Wounds.

Punctured wounds are produced by the penetration of a sharp or blunt-pointed substance, such as a thorn, fork, nail, &c., and the orifice of these wounds is always small in proportion to their depth. In veterinary practice punctured wounds are much more common than the others. They involve the feet most frequently, next the legs, and often the head and face from nails protruding through the stalls and trough. They are not only the most frequent, but they are also the most serious, owing to the difficulty of obtaining thorough disinfection. Another circumstance rendering them so is the lack of attention that they at first receive. The external wound is so small that but little or no importance is attached to it, yet in a short time swelling, pain, and acute inflammation, often of a serious character, are manifested.

Considering the most common of the punctured wounds, we must give precedence to those of the feet. Horses worked in cities, about iron works, around building places, &c., are most likely to receive "nails in the feet." The animal treads upon nails, pieces of iron or screws, and forces them into the soles of the feet. If the nail, or whatever it is that has punctured the foot, is fast in some large or heavy body, and is withdrawn as the horse lifts his foot, lameness may last for only a few steps; but unless properly attended to at once, he will be found in a day or two to be very lame in the injured member. If the foreign body remains in the foot, he gradually grows worse from the time of puncture until the cause is discovered and removed. If, when shoeing, a nail is driven into the "quick" (sensitive laminæ) and allowed to remain, the horse gradually evinces more pain from day to day; but if the nail has at once been removed by the smith, lameness does not, as a rule, show itself for some days; or, if the nail is simply driven "too close," not actually pricking the horse, he may not show any lameness for a week, or even much longer. At this point it is due the blacksmith to say that, considering how thin the walls of some feet are, the uneasiness of many horses while shoeing, the ease with which a nail is diverted from its course by striking an old piece of nail left in the wall, or from the nail itself splitting, the wonder is not that so many horses are pricked or nails driven "too close," but rather that many more are not so injured. It is not always carelessness or ignorance on the part of the smith, by any means, that is to account for this accident. Bad and careless shoers we do meet with, but let us be honest, and say that the rarity of these accidents points rather to the general care and attention given by these much-abused mechanics.

From the construction of the horse's foot (being encased in an impermeable horny box), and from the elasticity of the horn closing the orifice, punctured wounds of the feet are almost always productive of lameness. Inflammation results, and as there is no relief afforded by swelling and no escape for the product of inflammation, this matter must and does burrow between the sole or wall and the sensitive parts within it until it generally opens "between hair and hoof." We can thus see why pain is so much more severe, why tetanus (lockjaw) more frequently follows wounds of the feet, and why, from the extensive, or at times complete, separation and "casting" of the hoof, these wounds must always be regarded with grave apprehension.

Symptoms and Treatment.

A practice which, if never deviated from—that of picking up each foot, cleaning the sole, and thoroughly examining the foot each and every time the horse comes into the stable—will enable us to reduce the serious consequences of punctured wounds of the feet to the minimum. If the wound has resulted from pricking, lameness follows soon after shoeing; if from the nails being driven too close, it usually appears from four to five days or a week after receiving the shoe. We should always inquire as to the time of shoeing, examine the shoe carefully, and see whether it has been partially pulled and the horse stepped back upon some of the nails or the clip. The pain from these wounds is lancinating; the horse is seen to raise and lower the limb or hold it from the ground altogether; often he points the foot, flexes the leg, and knuckles at the fetlock. Swelling of the fetlock and back tendons is also frequently seen, and is apt to mislead us. The foot must be carefully examined, and this cannot be properly done without removing the shoe. The nails should be drawn separately and carefully examined. If there is no escape of pus from the nail holes, or if the nails themselves are not moist, we must continue our examination of the foot by carefully pinching or tapping it at all parts. With a little practice we can detect the spot where pain is the greatest, or discover the delicate line or scar left at the point of entrance of the foreign body. The entire sole is then to be thinned, after which we are to carefully cut down upon the point where pain is greatest upon pressure, and, finally, through the sole at this spot. When the matter has escaped, the sole, so far as it was undermined by pus, is to be removed. The foot must now be poulticed for one or two days, and afterwards dressed with a compress of oakum saturated with carbolic-acid solution or other antiseptic dressing.

If we discover a nail or other object in the foot, the principal direction, after having removed the offending body, is to cut away the sole, in a funnel shape, down to the sensitive parts beneath. This is imperative, and if a good free opening has been made and is maintained for a few days, hot fomentations and antiseptic dressings applied, the cure is mostly easy, simple, quick, and permanent. The horse should be shod with a leather sole under the shoe, first of all applying tar and oakum to prevent

any dirt from entering the wound. In some instances nails may puncture the flexor tendons, the coffin-bone, or enter the coffin joint. Such injuries are always serious, their recovery slow and tedious, and the treatment so varied and difficult that the services of a veterinarian will be necessary.

Punctured Wounds of Joints, or open Joints.

These wounds are more or less frequent. They are always serious, and often result in anchylosis (stiffening) of the joint or death of the animal. The joints mostly punctured are the hock, fetlock, or knee, though other joints may, of course, suffer this injury. As the symptoms and treatment are much the same for all, only the accident as it occurs in the hock joint will be described. Probably the most common mode of injury is from the stab of a fork, but it may result from the kick of another horse that is newly shod, or in many other ways. At first the horse evinces but slight pain or lameness. The owner discovers a small wound scarcely larger than a pea, and pays but little attention to it. In a few days, however, the pain and lameness become excessive; the horse can no longer bear any weight upon the injured leg; the joint is very much swollen and painful upon pressure; there are well-marked symptoms of constitutional disturbance—quick pulse [how to feel, see *Agricultural Gazette*, February, 1906], hurried breathing, high temperature, 103 degrees to 106 degrees F., the appetite is lost, thirst is present, the horse reeks with sweat, and shows by an anxious countenance the pain he suffers. He may lie down, though mostly he persists in standing, and the opposite limb becomes greatly swollen from bearing the entire weight and strain for so long a time. The wound, which at first appeared so insignificant, is now constantly discharging a thin whitish or yellowish fluid—joint oil or water—which becomes coagulated about the mouth of the wound and adheres to the part in clots like jelly, or resembling somewhat the white of an egg. Not infrequently the joint opens at different places, discharging at first a thin bloody fluid that soon assumes the character above described.

Treatment.

Treatment of these wounds is most difficult and unsatisfactory. We can do much to prevent this array of symptoms if the case is seen early—within the first twenty-four or forty-eight hours after the injury; but when inflammation of the joint is once fairly established the case becomes one of grave tendencies. Whenever a punctured wound of a joint is noticed, even though apparently of but small moment, we should, without the least delay, apply a strong cantharides blister over the entire joint, being even careful to fill the orifice of the wound with the blistering ointment. This treatment is almost always effectual. It operates to perform a cure in two ways—first, the swelling of the skin and tissues underneath it completely closes the wound and prevents the ingress of air; second, by the superficial inflammation established it acts to check

and abate all deep-seated inflammation. In the great majority of instances, if pursued soon after the accident, this treatment performs a cure in about one week, but should the changes described as occurring later in the joint have already taken place, we must then treat by cooling lotions and the application to the wound of chloride of zinc, 10 grains to the ounce of water, or a paste made up of flour and alum. A bandage is to hold these applications in place, which is only to be removed when swelling of the leg or increasing febrile symptoms demand it. In the treatment of open joints, our chief aim must be to close the orifice as soon as possible. For this reason repeated probing, or even injections, are contraindicated. The only probing of an open joint that is to be sanctioned is on our first visit, when we should carefully examine the wound for foreign bodies or dirt, and, after removing them, the probe must not again be used. The medicines used to coagulate the synovial discharge are best simply applied to the surface of the wound, on pledgets of tow, and held in place by bandages. Internal treatment is also indicated in those cases of open joints where the suffering is great. At first we should administer a light physic and follow this up with sedatives and anodynes, as directed for contused wounds. Later, however, we should give quinine, or salicylic acid in 1-drachm doses two or three times a day.

Wounds of the Tendon Sheath.

Wounds of tendon sheaths are similar to open joints in that there is an escape of synovial fluid, "sinew water." Where the tendons are simply punctured by a thorn, nail, or fork, we must, after a thorough exploration of the wound for any remaining foreign substance, treat with the flour and alum paste, bandages, &c., as for open joint. Should the skin and tendons be divided, the case is even more serious, and often incurable. There is always a large bed of granulations (proud flesh) at the seat of injury, and a thickening, more or less pronounced, remains. When the back tendons of a leg are severed, we should apply at once a high-heel shoe (which is to be gradually lowered as healing advances) and bandage firmly with a compress moistened with a 10-grain chloride of zinc solution. When proud flesh appears this is best kept under control by repeated applications of a red-hot iron. Mares that are valuable as brood animals and stallions should always be treated for this injury, as, even though blemished, their value is not seriously impaired. The length of time required and the expense of treatment will cause us to hesitate in attempting a cure, if the subject is old and comparatively valueless.

Poisoned Wounds.

These injuries are the result of bites of snakes, rabid dogs, stings of bees, wasps, &c. A single sting is not dangerous, but an animal is often stung by a swarm of insects, when the chief danger occurs from the swelling produced. If stung about the head, the nostrils may be closed

as a result of the swelling, causing laboured breathing and possibly asphyxiation. Intoxication may be produced by the absorption of this poison, and is manifested by staggering gait, spreading of the legs, paralysis of the muscles, difficult respiration, and a rise of temperature. Death may follow in five to ten hours.

Treatment.

Douse animal with cold water and apply any alkaline liquid, such as soapsuds, bicarbonate of soda, or weak solution of ammonia. Internally give alcohol, ether, or camphor to strengthen the heart. In the case of bites by poisonous snakes, a painful swelling occurs about the bitten part, which is followed by laboured breathing, weakness, retching, fever, and death from collapse. The animal usually recovers if it can be kept alive over the third day. In treating the animal, a tight ligature should be passed about the part above the wound to keep the poison from entering the general circulation. Wash out the wound thoroughly with antiseptics and then apply a caustic, such as silver nitrate, or burn with a hot instrument. A subcutaneous injection of ¼ drachm of 1 per cent. solution of chromic acid above the wound is also beneficial. Cold water may be applied to the wound to combat the inflammation.

Harness Galls (Sitfasts).

Wounds or abrasions of the skin are frequently caused by ill-fitting harness or saddles. When a horse has been resting from steady work for some time, particularly after being kept idle in a stable on a scanty allowance of grain, as in winter, he is soft and tender and sweats easily when put to work again. In this condition he is apt to sweat and chafe under the harness, especially if it is hard and poorly fitted. This chafing is likely to cause abrasions of the skin, and thus pave the way for an abscess, or for a chronic blemish, unless attended to very promptly. Besides causing the animal considerable pain, chafing, if long continued, leads to the formation of a callosity. This may be superficial, involving only the skin, or it may be deep-seated, involving the subcutaneous fibrous tissue and sometimes the muscle and even the bone. This causes a dry slough to form, which is both inconvenient and unsightly. Sloughs of this kind are commonly called "sitfasts," and, while they occur in other places, are most frequently found under the saddle.

Treatment.

Abrasions are best prevented by bringing the animal gradually into working shape after it has had a prolonged rest, in order that the muscles will be hard and the skin tough. The harness should be well fitted, neither too large nor too small, and it should be cleaned and oiled to remove all dirt and to make it soft and pliable. Saddles should be properly fitted, so as to prevent direct pressure on the spine, and the saddle cloth should be clean and dry. Parts of the horse where chafing,

is likely to occur, as on the back under the saddle, should be cleaned and brushed free of dirt.

The remedies for simple harness galls are numerous. Among them may be mentioned alcohol, 1 pint, in which are well shaken the whites of two eggs; a solution of nitrate of silver, 10 grains to the ounce of water; sugar of lead or sulphate of zinc, 20 grains to an ounce of water; carbolic acid, 1 part in 15 parts of glycerine, and so on almost without end. Any simple astringent wash or powder will effect a cure, provided the sores are not irritated by friction.

If a sitfast has developed, the dead horn-like slough must be carefully dissected out and the wound treated carefully with antiseptics. During treatment it is always best to allow the animal to rest, but if this is inconvenient, care should be taken to prevent injury to the abraded or wounded surface by padding the harness so that chafing cannot occur.

Ulceration.

An ulcer is a circumscribed area of necrosis occurring on the skin or mucous membrane, and covered with granulation tissue. It is a process of destruction, and when this process is going on faster than regeneration can take place, we have a knawing, or eating, ulcer. When such an ulcer increases rapidly in size it is termed a phagedenic ulcer. A fungoid ulcer is one in which the bottom of the ulcer projects beyond the edge of the skin. These ulcers secrete milky or bloody-white liquid, called ichor. When the ulcer is of an ashen or leaden colour, with the bottom and sides formed of dense, hard connective tissue, which gives but little discharge and is not sensitive, it is termed callous, torpid, or indolent ulcer.

Causes.

Disturbances of circulation are among the most frequent causes. A wound to a tissue with slight recuperative power may be followed by ulceration, as in tumors. Certain germs may produce ulcers, as the glanders bacilli, which cause the ulcerations on the nasal septum in glanders.

Treatment.

This consists in removing at once the exciting cause. The secretions of the ulcer should be washed off with antiseptic solutions and the formation of granulation tissues stimulated by antiseptic salves, such as carbolated vaseline, lead ointment, or by dressings of camphor. Air should be kept from the ulcer by occlusive dressings. Where the ulcers are inflamed, warm lead-water or lead-water and laudanum will be found efficacious. Callous ulcers are best removed by a curet, knife, or hot iron, and then treated like a common wound. Mechanical irritation should be avoided.

Abscesses.

These consist of accumulations of pus within circumscribed walls, at different parts of the body, and may be classed as acute, and cold, or chronic abscesses.

When an abscess occurs about a hair follicle it is called a boil or furuncle; when several hair follicles are involved, resulting in the formation of more than one exit for the inflammatory products, it is called a carbuncle.

Acute Abscesses.

Acute abscesses follow as the result of local inflammation in glands, muscular tissue, or even bones. They are very common in the two former. The abscesses most commonly met with in the horse (and the ones which will be here described) are those of the salivary glands, occurring during the existence of "strangles," or colt distemper." The glands behind or under the jaw are seen to slowly increase in size, becoming firm, hard, hot, and painful. At first the swelling is uniformly hard and resisting over its entire surface, but in a little while becomes soft—fluctuating—at some portion, mostly in the centre. From this time on the abscess is said to be "pointing," or "coming to a head," which is shown by a small elevated or projecting prominence, which at first is dry, but soon becomes moist with transuded serum. The hairs over this part loosen and fall off, and in a short time the abscess opens, the contents escape, and the cavity gradually fills up—heals by granulations.

Abscesses in muscular tissue are usually the result of bruises or injuries. In all cases where abscesses are forming, we should hurry the ripening process by frequent hot fomentations and poultices. When they are very tardy in their development, a blister over the surface is advisable. It is a common rule with surgeons to open an abscess as soon as pus can be plainly felt, but this practice can scarcely be recommended to owners of stock indiscriminately, since this little operation frequently requires an exact knowledge of anatomy. It will usually be found the better plan to encourage the full ripening of an abscess and allow it to open unaided. This is imperative if the abscess is in the region of joints, &c. When open, we must not squeeze the walls of the abscess to any extent. They may be very gently pressed with the fingers at first to remove the clots—inspissated pus—but after this the orifice is simply to be kept open by the introduction of a clean probe, should it be disposed to heal too soon. If the opening is at too high a level another should be made into the lowest portion of the abscess, so as to permit the most complete drainage. Hot fomentations or poultices are sometimes required for a day or two after an abscess has opened, and are particularly indicated when the base of the abscess is hard and indurated.

The cavity should be thoroughly washed with stimulating antiseptic solutions, such as 3 per cent. solution of carbolic acid, 3 to 5 per cent. solution of creolin, 1 to 1,000 bichloride of mercury, or 1 per cent. permanganate of potash solution. If the abscesses are foul and bad smelling, their cavities should be at first syringed with 1 part of hydrogen peroxide to 2 parts of water, and then followed by the injection of any of the above-mentioned antiseptics.

Cold Abscesses.

Cold abscess is the term applied to those large, indolent swellings that are the result of a low, or chronic, form of inflammation, in the centre of which there is a small collection of pus. They are often seen near the point of the shoulder, forming the so-called breast-boil. The swelling is diffuse and of enormous extent, but slightly hotter than surrounding parts, and not very painful upon pressure. There is a pronounced stiffness, rather than pain, evinced upon moving the animal. Such abscesses have the appearance of a hard tumor, surrounded by a softer edematous swelling, involving the tissues to the extent of a foot or more in all directions from the tumor. This diffused swelling gradually subsides and leaves the large, hardened mass somewhat well defined. One of the characteristics of the cold abscesses is their tendency to remain in the same condition for a great length of time. There is neither heat nor soreness; no increase or lessening in the size of the tumor; it remains *in statu quo*. If, however, the animal should be put to work for a short time, the irritation of the collar causes the surrounding tissues to again assume an edematous condition, which after a few days' rest disappears, leaving the tumor as before, or but slightly larger. Upon careful manipulation we may discover what appears to be a fluid deep seated in the centre of the mass. The quantity of matter so contained is very small—often not more than a tablespoonful—and for this reason it cannot, in all cases, be detected.

Cold abscesses are mostly, if not always, caused by the long-continued irritation of a loose and badly fitting collar. There is a slow inflammatory action going on, which results in the formation of a small quantity of matter enclosed in very thick and but partially organised walls, that are not as well defined as the circumference of fibrous tumors, which they most resemble.

Treatment.

The means recommended to bring the acute abscess "to a head" are but rarely effectual with this variety; or, if successful, too much time has been occupied in the cure. We must look for other and more rapid methods of treatment. These consist, first of all, in carefully exploring the tumor for the presence of pus. The incisions must be made over the softest part and carried deep into the tumor (to its very bottom, if necessary), and the matter allowed to escape. After this, whether we have found matter or not, we must induce an active inflammation of the tumor in order to promote solution of the thick walls of the abscess. This may be done by inserting well into the incision a piece of oakum or cotton saturated with turpentine, carbolic acid, tincture of iodine, &c., or we may pack the incision with powdered sulphate of zinc and keep the orifice plugged for twenty-four hours. These agents set up a destructive inflammation of the walls; suppuration follows, and this should now be

encouraged by hot fomentations and poultices. The orifice must be kept open, and should it be disposed to heal we must again introduce some of the agents above described. A favoured treatment with many, and it is probably the best, is to plunge a red-hot iron to the bottom of the incision and thoroughly sear all parts of the walls of the abscess. This is to be repeated after the first slough has taken place, if the walls remain thickened and indurated.

It is useless to waste time with fomentations, poultices, or blisters in the treatment of cold abscesses, since, though apparently removed by such methods, they almost invariably return when the horse is put to work. Extirpation by the knife is not practicable, as the walls of the tumor are not sufficiently defined. If treated as above directed, and properly fitted with a good collar after healing, there will not remain any track or trace of the large unsightly mass.

Fistulas.

Definition.

The word fistula is applied to any ulcerous lesion upon the external surface of the body which is connected by ducts, or passages, with some internal cavity. Because of this particular formation, the term fistulous tract is often used synonymously with the word fistula. Fistulas may exist in any part of the body, but the name has come to be commonly accepted as applicable only to such lesions when found upon the withers. Poll evil is a fistula upon the poll, and in no sense differs from fistulous withers except in location. The description of fistula will apply, then, in the main, to poll evil equally well. Quittor presents the characteristic tubular passages of a fistula, and may therefore be considered and treated as fistula of the foot. Fistulous passages may also be developed upon the sides of the face, through which saliva is discharged instead of flowing into the mouth, and are called salivary fistulæ. A dental fistula may arise from the necrosis of the root of a tooth. Again, a fistula is sometimes noted as the umbilicus associated with hernia, and recto-vaginal fistulas have been developed in mares, following difficult parturition. Fistulas may arise from the wounds of glandular organs or their ducts, and thus we have the so-called mammary, or lachrymal, fistulas.

Fistulous tracts are lined with a false, or adventitious, membrane, and show no disposition to heal. They constantly afford means of exit to the pus or ichorous material discharged by the unhealthy parts below. They are particularly liable to develop at the withers or poll because of the exposed positions which these parts occupy, and, having once become located there, they usually assert a tendency to further extension, because the vertical and laminated formation of the muscles and tendons of these parts allows the forces of gravitation to assist the pus in gaining the deeper-lying structures and also favours its retention among them.

Causes.

Fistulas follow as a result of abscesses, bruises, wounds, or long-continued irritation by the harness. Among the more common causes of fistula of the poll (poll evil) are chafing by the halter or heavy bridle; blows from the butt end of the whip; the horse striking his head against the hayrack, beams of the ceiling, low doors, &c. Fistulous withers are seen mostly in those horses that have thick necks, as well as those that are very high in the withers; or, among saddle horses, those that are very low in the withers, the saddle here riding forward and bruising the parts. They are often caused by bad-fitting collars or saddles, by direct injuries from blows, and from the horse rolling upon rough or sharp stones. In either of these locations, ulcers of the skin, or simple abscesses, if not properly and punctually treated, may become fistulas. The pus burrows and finds lodgment deep down between the muscles, and escapes only when the sinus becomes surcharged or when, during motion of the parts, the matter is forced to the surface.

Symptoms.

These, of course, will vary according to the progress made by the fistula. Following an injury we may often notice soreness or stiffness of the front legs, and upon careful examination of the withers we will see small tortuous lines running from the point of irritation downward and backward over the region of the shoulder. These are superficial lmyphatics, and are swollen and painful to the touch. In a day or two a swelling is noticed on one or both sides of the dorsal vertebræ, which is hot and painful and rapidly enlarging. The stiffness of the limbs may disappear at this time, and the heat and soreness of the parts may become less noticeable, but the swelling remains and continues to enlarge.

A fistulous ulcer of the poll may be first indicated by the opposition which the animal offers to the application of stable brush or bridle. At this time the parts are so sore and sensitive that there is some danger that the patient will acquire disagreeable stable habits unless handled with the greatest care. The disease in its early stages may be recognised as a soft, fluctuating tumor, surrounded by inflammatory swelling, with the presence of enlarged lymphatic vessels and stiffness of the neck. Later the inflammation of the surrounding tissues may disappear, leaving a prominent tumor. The swelling, whether situated upon the head or the withers, may open and form a running ulcer, or its contents may dry up and leave a tumor which gradually develops the common characteristics of a fibrous tumor. When the enlargement has opened we should carefully examine its cavity, as upon its condition will wholly depend our treatment.

Treatment.

In the earliest stage, when there is soreness, enlarged lymphatics, but no well-marked swelling, the trouble may frequently be aborted. To do this requires both general and local treatment. A physic should be

given, and the horse receive 1 ounce of powdered saltpetre three times a day in his water or feed. If the fever runs high, 20-drop doses of tincture of aconite root every two hours may be administered. The local application of cold water to the inflamed spot for an hour at a time three or four times a day has often proved very beneficial, and has afforded great relief to the patient.

Cooling lotions, muriate of ammonia, or saltpetre and water; sedative washes, such as tincture of opium and aconite, chloroform liniment, or camphorated oil, are also to be frequently applied. Should this treatment fail to check the progress of the trouble, the formation of pus should be hastened as rapidly as possible. Hot fomentations and poultices are to be constantly used, and as soon as the presence of pus can be detected, the abscess wall is to be opened at its *lowest point*. In this procedure lies our hope of a speedy cure. As with any simple abscess, if drainage can be so provided that the pus will run off as fast as formed without remaining within the interstices of the tissues, the healing which follows will be rapid and satisfactory.

Attention is again called to the directions given above as to the necessity of probing the cavity when opened. If upon a careful examination with the probe we find that there are no pockets, no sinuses, but a simple, regular abscess wall, the indication for treatment is to make an opening from below so that the matter must all escape. Rarely is anything more needed than to keep the orifice open and to bathe or inject the parts with some simple antiseptic wash that is not irritant or caustic. A low opening and cleanliness constitute the essential and rational treatment.

If the abscess has already opened, giving vent to a quantity of purulent matter, and the pipes and tubes leading from the opening are found to be extensive and surrounded with thick fungoid membranes, there is considerable danger that the internal ligaments, or even some of the bones, have become affected, in which case the condition has assumed a serious aspect. Or, on the other hand, if the abscess has existed for some time without a rupture, its contents will frequently be found to consist of dried purulent matter, firm and dense, and the walls surrounding the mass will be found greatly thickened. In such a case, we must generally have recourse to the application of caustics which will cause a sloughing of all of the unhealthy tissue, and will also stimulate a rapid increase of healthy organised material to replace that destroyed in the course of the development and treatment of the disease. Threads or cords soaked in gum-arabic solution and rolled in powdered corrosive sublimate may be introduced into the canal and allowed to remain. The skin on all parts of the shoulder and leg beneath the fistula should be carefully greased with lard or oil, as this will prevent the discharge that comes from the opening after the caustic is introduced from irritating or blistering the skin over which it flows. In obstinate cases a piece of caustic potash (fused) 1 to 2 inches in length may be introduced into the opening, and should be covered with oakum or cotton. The horse should

then be secured so that he cannot reach the part with his teeth. After the caustic plug has been in place for twenty-four hours, it may be removed and hot fomentations applied. As soon as the discharge has become again established, the abscess should be opened from its lowest extremity, and the passage thus formed may be kept open by the introduction of a seton. If the pipes become established in the deep tissues beneath the shoulder blade or among the spines of the vertebral column, it will often be found impossible to provide proper drainage for the abscess from below, and treatment must consist of caustic solutions carefully injected into all parts of the suppurating sinuses. A very effective remedy for this purpose consists of 1 ounce of chloride of zinc in ½ pint of water, injected three times during a week, after which a weak solution of the same may be occasionally injected. Injections of Villate's solution or alcoholic solution of corrosive sublimate, strong carbolic acid, or possibly oil of turpentine, will also prove beneficial. Pressure should be applied from below, and endeavours made to heal the various pipes from the bottom.

Should the swelling become general, without forming a well-defined tumor, the placing of 20 to 30 grains of arsenious acid, wrapped in a single layer of tissue paper, in a shallow incision beneath the skin, will often produce a sloughing of the affected parts in a week or ten days, after which the formation of healthy tissue follows. The surrounding parts of the skin should be protected from any damage from escaping caustics by the application of lard or oil, as previously suggested.

Although the successful treatment of fistulas requires time and patience, the majority of cases are curable. The sinuses must be opened at their lowest extremity and kept open. Caustic applications must be thoroughly used once or twice, after which mild astringent antiseptic washes should be persistently used until a cure is reached.

It sometimes happens that the erosions have burrowed so deeply or in such a direction that the opening of a drainage passage becomes impracticable. In other cases the bones may become attacked in some inaccessible location, or the joints may be affected, and in these cases it is often best to destroy the horse at once.

The reappearance of the fistula after it has apparently healed is not uncommon. The secondary attack in these cases is seldom serious. The lesion should be carefully cleansed and afterwards injected with a solution of zinc sulphate, 20 grains to the ounce of water, every second or third day until a cure is effected.

In fistula of the foot we see the same tendency towards the burrowing of pus downward to lower structures, or in some cases upward toward the coronet. Prior to the development of a quittor there is always swelling at the coronet, accompanied by heat and pain. Every effort should now be made to prevent the formation of an abscess at the point of injury. Wounds caused by nails, gravel, or any other foreign body which may have become lodged in the sole of the foot, should be opened

at once from below so as to allow free exit to all purulent discharges. Should the injury have occurred directly to the coronet the application of cold fomentations may prove efficient in preventing the formation of an abscess.

When a quittor becomes fully established it should be treated precisely as a fistula situated in any other part of the body: that is, the sinuses should all be opened from their lowest extremities so as to afford constant drainage. All fragments of diseased tissue should be trimmed away, antiseptic solutions injected, and, after covering the wound with a pad of oakum saturated with some good antiseptic wash, the whole foot may be carefully covered with clean bandages, which will afford valuable assistance to the healing process by excluding all dirt from the affected part.

Report on Forest-damaging Insect, *Podacanthus wilkinsoni*, in the Glen Innes District.

W. W. FROGGATT, F.L.S.,
Government Entomologist.

I beg to report that, acting on instructions, I visited the district on the eastern watershed, about 30 miles from Glen Innes, in company with Forester Stewart, to report upon the damage being done to the forest trees by the gregarious phasmids or stick insects (*Podacanthus wilkinsoni*).

Last year I investigated their range and habits in the Nowendoc District, about 70 miles south-east of Walcha, the only district in which, up till now, they were known to exist, and the finding of them about 120 miles north of the original locality shows that they have a very much wider range than hitherto suspected. At the mill where we camped the whole forest (with the exception of the she-oaks and honeysuckles) was stripped of every green leaf for a distance of about 6 miles in length and several miles in width; giant gums and tiny saplings were as bare as if they had been burnt off, and the whole expanse of country dull brown in tint On the western edge of this area the moving millions of phasmids swarmed over the grass, were crawling up the tree trunks, and festooning the foliage as thick as a plague of locusts on a western plain. If one stood still for a few moments, a score would be climbing over one's legs and back, and the horses were stamping and kicking all the time to shake them off. At the mill they climbed or flew on to the engine in such numbers that the roasted remains had to be shovelled off.

They are large, handsome, green insects, both sexes with well-developed flying, purple, gauzy wings; but, unless when blown from the tops of the trees, their usual mode of progression is crawling. As pointed out in my former report, through the damage they do to the valuable timber in aborting its growth and causing the young wood to die back (for such defoliation will not kill the trees), it may become a very serious enemy to our eucalyptus forests, and a difficult one to deal with.

Investigations into the Effect of Copper Sulphate on Plants.

The Journal of the Board of Agriculture.

The influence of copper and copper salts on plant life has formed at different times the subject of many experiments. It was early known that copper in its soluble combinations was poisonous to the living cells both of the lower and higher plants, but in 1885 Millardet showed also that an insoluble or hardly soluble combination of copper, in the form known as the Bordeaux mixture, was an excellent fungicide—a discovery which was of special importance as affording a means of combating various injurious fungi on the leaves of cultivated plants. This, as is well known, is a mixture of sulphate of copper and calcium hydrate, which is distributed on the leaves in the form of a fine spray. Spraying of this kind has been observed under some circumstances to exercise a certain effect on the leaves and on the development of healthy plants, and in a lengthy article in the *Landwirtschaftliche Jahrbücher* (Vol XXXIII., 1904. Part 4–5) Herr Richard Schander deals with the question in its different aspects, confining his attention, however, exclusively to the effect of the copper solution on the living plant and not on the fungi.

Bordeaux mixture has been considered by various investigators to exercise a beneficial influence in the following way :—(1) The leaves appeared firmer, more robust and thicker; (2) they were of a deeper green colour; (3) the assimilation of the leaves was increased; (4) the amount of transpiration was changed; and (5) the duration of vegetation was lengthened. Other investigators, however, have arrived at a different conclusion, so far as general effect is concerned, and have showed that the Bordeaux mixture checked the development of the plant and resulted in a smaller yield.

By far the greater part of the experimenters attributed the effect of the Bordeaux mixture to the copper hydrate. According to one view the copper salts, without penetrating into the leaf, exercise a stimulating influence on the cells. Another view is that the smallest copper particles, partly with and partly without assistance from the cell sap, penetrate the cuticle and epidermis into the cells of the leaves and exercise a chemico-physiological stimulus on the protoplasm of the leaf-cells. Others, again, believe that the copper salts reaching the soil through the spraying are taken up by the roots and so affect favourably the development of the plant.

With regard to the first of these views Herr Schander regards the explanations given by its supporters as improbable. With regard to the second he states that it follows from experiments which have been made that the epidermis of the leaves is able to hinder the penetration of copper solutions,

but that the copper, once penetrated, behaves in the same way towards the protoplasm of the leaf-cells as to the cells of algæ and fungi (referred to in the experiments quoted), and can injure the protoplasm even in such weak solutions as 1 to 100,000,000. It would appear, therefore, very hazardous to assume that the copper penetrates into the leaf and there exercises a beneficial influence.

The effect on plants of the copper left in the soil by spraying can never be beneficial. The author points out that in any case the effect must become apparent much later than the application of the solution, as it would be absorbed by the soil and could only reach the roots when washed out by rain. He considers, however, that it is proved by experiment that copper is injurious, and, moreover, that plants could only absorb a very small quantity of it without injury.

Among the other causes mentioned by the author which might have some effect are the action of the lime in the Bordeaux mixture and the effect of the spraying in preventing insect attacks, and, finally, the influence of the thin coating of copper on the assimilation and transpiration of the leaves. The latter point is one to which Herr Schander devotes considerable attention. He considers that the coating protects the chlorophyll against the prejudicial influence of intense sunshine and diminishes the transpiration of the leaves, thus explaining the beneficial effect which the application of Bordeaux mixture has frequently been observed to have on the leaves. No chemical action takes place, the result being entirely due to the modification in the intensity in the light produced by the thin coating of copper. In the case of the vine, the protection of the leaves against the effects of excessive sunshine might be advantageous, and Herr Schander suggests that the strength of the Bordeaux mixture might be regulated according to the character of the season; thus in a hot, dry summer a high percentage solution might be employed, while in a wet, dull year a 1 per cent. solution could be applied, which would still be sufficiently strong to destroy fungi.

There is one other point of considerable practical interest which is dealt with in this paper, and that is the cause of the occasional injury to leaves and fruit caused by copper solutions. Whilst observation has shown that this injury most frequently occurs with solutions containing too little lime, it may also happen when an excess of lime has been used; the leaves of some plants are more easily affected than others, while the injurious effects appear to occur very irregularly and more in one year than another.

It would seem that lime is able to restrain, but not entirely to prevent, the injurious effect of the copper sulphate, and that the effect is more or less dependent on meteorological conditions, many cases of injury, for instance, occurring in the wet summer of 1902. In the case of peach leaves and apples, it would seem that the addition of quicklime in excess is by no means completely able to prevent injury, and against a too great excess of lime it must be remembered that the adhesibility of the solution to the leaves is thereby much diminished, whereas, so far as our knowledge goes at present, a solution is the more valuable the better and the longer it adheres to the leaf.

Moreover, the fungicidal effect of the solution depends simply and solely on its content of copper hydrate, and it operates only so long as it exists actually as a coating on the leaf. A too great excess of lime is necessarily associated with a reduction in the percentage of copper hydrate in the solution, so that its fungicidal effect is diminished. Thus we have no means entirely to prevent its virulent action, particularly in the case of peach and certain apple trees. Herr Schander's view is that peach trees should, if possible, not be sprayed at all—at any rate, never during rainy weather. If, however, it be done, it is imperative to use two parts of quicklime to one of copper sulphate.

In spraying vines, apples, pears, and potatoes, there is no reason to depart from the customary proportions, viz., one part of copper sulphate to one of quicklime. Injury only takes place in specially unfavourable years, and then it cannot be avoided. The employment of a solution giving an alkaline reaction is not considered advisable, on account of the more easy solubility of the copper hydrate in such a solution. Moreover, it is easier to mix the solution with equal portions of each component than to be obliged frequently to test for an alkaline reaction; on the other hand, it may easily happen that a solution is used containing free copper sulphate.

In conclusion, Herr Schander observes that decidedly too much importance has been attached to the physiological influence of the coating of Bordeaux mixture on the green leaf: the beneficial action of the copper on the higher plants was in no case observed in his experiments. In his opinion the Bordeaux mixture should only be used as a protection against fungi, though in certain cases one may usefully employ its power of affording protection from the sun to which reference has been made above.

Monthly Weather Report.

HAWKESBURY AGRICULTURAL COLLEGE.

Summary for March, 1906.

Air Pressure. (Barometer.)			Shade Temperature.				Air Moisture Saturation=100.			Evaporation (from Water Surface).			
Lowest.	Highest.	Mean.	Lowest.	Highest.	Mean.	Mean for 14 years.	Lowest.	Highest.	Mean.	Most in a Day.	Total for Month.	Monthly Mean for 8 years.	% of year's Evaporation.
29·82 11th	30·42 4th.	30·13	44·1 30th.	93·0 2nd.	67·125	68·511	44 15th.	95 26th & 27th	70	·262 2nd.	4·043	4·561	8·8

Rainfall (as recorded)																				
Dates.	1	2	3	4	5	6	7	8	9	12	16	23	25	26	27	28	29	30	Total,	Mean Rainfal for 14 years.
Points	3	1	12	10	10	8	5	34	4	37	3	6	37½	31	111	11	6	1	330½	389

Wind	N	NE	E	SE	S	SW	W	NW
	1	1	...	5	8	6	3	1

Thunderstorms on dates—24.

Greatest daily range of temperature, 35°·6, on 24th. Extremes of rainfall, 1·018 (1902), 16·217 (1894).
Days on which shade temperature rose above 90° Fahr.—2nd, 93; 12th, 90·9.

Remarks.—A cool dull month; good rain in the last week.

CHAS. T. MUSSON,
W. MERVYN CARNE,
Observers.

Reports from the Commercial Agents.

THE MINISTER FOR MINES AND AGRICULTURE has received a report from Mr. Valder, Commercial Agent at Cape Town, on the subject of eggs. He says:—

"Imported eggs are now bringing from 10s. 6d. to 11s. per 100, and eggs of the quality sent by a Sydney firm some while time since would probably bring a little more than this. During the past season Canada has done a good business here with eggs sent over in cold storage, and I think that it would pay our exporters to try small shipments sent in this way. Several of the egg merchants have called to know if there is any likelihood of any more consignments from New South Wales, as they consider that they would sell well here.

"It seems to me that a good business can be done in this direction, but it is necessary that merchants should appoint reliable agents here to handle them. These agents would take orders and see that the eggs were properly looked after at this end. Shipping goods on consignment is a mistake, as although the majority of the merchants may be trusted without fear, there is always a risk.

MARKET PRICES, CAPE TOWN, 20TH MARCH, 1906.

Beef	Equal number hinds and fores	2⅜d to 3¼d. per lb., c.i.f.
,,	Extra hinds, ½d. per lb. extra.	
Mutton	Wethers	2¾d. to 3¼d. ,,
,,	Ewes	2½d. to 2¾d. ,,
Porkers	45 lb. to 70 lb., Australian	5¼d. ,,
,,	60 lb. to 80 lb.	5⅝d. ,,
,,	American	6½d. ,,
Bacon		7¼d. ,,
Butter	Victorian	bulk 11½d., pats 11¾d. per lb., c.i.f.
,,	New South Wales	,, 10½d., ,, 10¾d. ,,
,,	Argentine	,, 10d., ,, 10¼d ,,
,,	Queensland	,, 9d., ,, 9¼d ,,
Cheese	Cheddar	7½d. per lb, c.i.f.
Wheat	Australian, f.a.q.	6s. 5d. per 100 lb., c.i.f
Flour	,, ,,	8s. ,,
Bran	,, ,,	5s. 4½d. ,,
,,	New Zealand	4s. 11d. ,,
Oats...	,,	6s. 6d. ,,
,, ...	Algerian Feed, Australian	6s. 5d. ,,
,, ...	,, Seed ,,	7s. 1d. ,,
,, ...	,, Feed, Argentine	5s. 9d. ,,
Compressed Fodder		3s. 8d. ,,
Potatoes, local		12s. to 13s. per bag, 150 lb.
Onions, local		5s. 6d. per bag, 125 lb.
Eggs, local new-laid		15s. to 17s. per 100.
,, imported		11s. per 100.
Maize		12s. per bag of 200 lb.
Rabbits, 1st Grade		10s. per crate, f.o.b. Sydney.

"Both mutton and beef were firmer this week, 3¼d. being asked in several instances. Wheat and flour a little easier. Oats, especial for seed, were dearer. Eggs getting slightly dearer. The season has been rather a bad one for the apple crop here, and it is anticipated that there will be a run on Australian apples shortly. One firm told me that they would be able to do with 2,000 cases per month, provided cold storage could be obtained. The Canadian and American apples brought over in barrels in cold storage sold remarkably well this season, but there are no more available. The demand for canned fruits is again good, but unfortunately our canners do not appear to be able to keep up the supply.

"Trade generally is still very dull, and large numbers of men are unemployed. I attach a cutting taken from the February report of the Government Labour Bureau, from which it will be seen that even men who are used to the conditions of the country cannot find employment and are leaving South Africa."

GOVERNMENT LABOUR REPORT.

The local supply of labour continues to be much in excess of the demand, the majority of those unemployed belonging to the building and allied trades. About 130 men have recently been discharged by the Harbour Board, of whom a large proportion (especially Europeans) have great difficulty in obtaining other suitable employment, and, in consequence, many are compelled to seek work in other countries.

FRUIT AND VEGETABLE MARKET, 19TH MARCH, 1906.

	s. d.	s. d.
Potatoes, 100 lb.	4 8	7 4
Onions, per bag	4 0	5 6
Watermelons, each	0 1	0 8½
Apples, 100	0 7	4 8
Eggs, 100	8 0	14 0
Lemons, 100	1 6	6 10
S. potatoes, bag	7 0	9 0
Ducks, each	3 3	3 3
Fowls, each	2 1	2 8
Pears, 100	2 0	7 6

Orchard Notes.

W. J. ALLEN.

MAY.

To the majority of growers the past fruit season has been one of the poorest experienced for many years, as, with the exception of apricots, crops have all been light. The prices, however, have been high, some of our best-coloured dessert apples selling in the local markets at from 15s. to 16s. per case; while others, not so well coloured, sold at from 13s. to 14s. per case by auction. For those who are not afraid of a little work, there is no industry which at the present time promises better than apple-growing. For dessert purposes, the public demand a well-flavoured highly-coloured fruit, of good size, and free from disease, and for such fruit they are ready to pay handsome prices. Those in our colder districts who have good apple country could, with advantage, give this industry more attention than they have done hitherto, as no better flavoured fruit is seen on our markets than that grown in this State, in orchards which have been intelligently worked. pruned, and manured.

It seems ridiculous that up to the present we have come so far short of supplying the demand in this State. Many attribute this state of affairs to the want of a Fruit Pests Bill, others to lack of energy and neglect to give the trees the proper care and attention at the different seasons of the year. There is no use of cultivating an orchard well if you are not going to spray, &c., in order to keep in check codlin moth, bitter pit, and other diseases.

The citrus crop promises to be light this season, and to those who are situated in districts where the fruit will hang, my advice is not to rush too much fruit at a time on the market, as the demand will be greater than the supply, and, consequently, good prices should rule throughout the season for well-grown fruit. The late rains have given the ground a good soaking, and the fruit on the trees should fill out quickly, now that we are having moderately warm weather. The green manure crops and weeds will also make good growth.

In citrus orchards there is a certain amount of work which must be looked after, such as picking up windfalls and pulling some of the riper fruit which it is intended to market. Also, there is the ripe passion fruit to handle in some of the vineyards; but wherever possible avoid going on the orchard while the ground is very wet.

Refills in deciduous orchards may be planted out this month if the young trees are available. The earlier they are planted now the stronger they will start away in the spring.

Working soil which is wet in the fall of the year tends to pack it and make it hard, so that it is as well to let it have as complete a rest as possible for the next month or two.

This has been a very poor season for drying prunes, sultanas, and raisin grapes, late peaches, &c., as the weather has been cool and rather wet, consequently the fruit ripened late, and never became as sweet as it usually does when the season is normal.

Ever since my advent into the Department of Agriculture, in 1897, I have persistently tried to get peach-growers to go in for varieties such as the Elberta, Comet, Lady Palmerston, Salwey, Chair's Choice, Brandywine, Foster, or any other good yellow-fleshed, freestone varieties, for canning or jam-making purposes, which are also good dessert varieties. Now that our canning factories are growing in size and number, and the public are slowly but surely taking to the consumption of more fruit, either in the fresh or cooked state, it behoves us as growers to see that we supply the varieties they want, so they will not have to send out of the State for such fruits as those which grow to perfection here. The better the quality of canned fruit and jam put up by our factories here, the greater will be the demand for such goods, and anything which helps to increase the demand for such fruits must, of necessity, be good for the grower as well as the proprietor of the canning factory. Therefore, let the grower raise only the best sorts, give the trees the care they require, and I venture to predict that the results will be highly satisfactory.

Fumigating Citrus trees.—Never treat the trees in the fall of the year when they are out of condition, as it is after the trees have passed through a long dry spell, that they are most readily damaged by either spraying or the effects of the gas.

Farm Notes.

Hawkesbury District—May.

H. W. POTTS.

So much depends upon the weather, that no positive or definite directions may be given of a precise nature in the work to be continued this month on the farm. Although April was a dry month in this district, yet there was sufficient moisture to enable farmers to conduct tillage operations in a vigorous way. The advent of the Easter Show doubtless entailed a break in the work, seeing this season's display at the Royal Agricultural Society's Exhibition was unique in the character and quality of the exhibits in all sections, and certainly excelled all previous shows. This month may be looked on as a very busy one, in order to take full advantage of the season. It is a good maxim in farming to adhere to, that an early-sown crop is preferable to a late-sown one. Farming operations are largely controlled and regulated by "seasons" more than by the scope or profitable nature of the rains; hence, local conditions of soil and rainfall determine the nature of our operations. This season promises to be a prolific one, and whilst prices may be low, we compensate that in the extra yields.

Wheat.—Sowings of the main varieties may be continued, such as Bobs, Nonpareil, White Lammas, and Australian Talavera. The macaroni wheats may also be sown for green fodder. The main wheat crops can be finished this month.

Oats.—This valuable crop can be extended also, for providing green fodder and hay in early spring. The Algerian invariably gives us the best results. Where the previous crop was a leguminous one, the application of manure may be reduced in quantity.

Barley.—A further sowing of Cape barley may be made for green fodder, as well as Skinless barley. Where barley is required for malting purposes, English Chevalier and Carter's Prize Prolific afford the most reliable yields.

Lucerne or Clover may each be put in this month, but not later,

Rye.—Many parts of this district, especially on the lighter sandy loams, are eminently suitable for the hardy varieties of rye. Where the richer cereals do not thrive, rye crops provide good returns, both for green fodder, grain, and straw. The frosts do not affect its growth, and it is certainly one of the most reliable crops in this district. Thousandfold and Emerald are both reliable varieties to sow.

Sweet Potatoes and Artichokes should be dug this month and stored.

Carrots and Parsnips.—Small sowings of these useful roots for cattle may be made.

Onions can be largely sown this month.

Turnips, Swedes, and Rape.—Small sowings may be continued.

Field Peas.—Santoy's Grey, Dane, or Blue peas can be sown this month.

Tares or Vetches.—The seed of these very useful legumes were scarce in the early part of the season, but are available now. It is too late to sow alone; but they may be added to the sowings of barley or oats.

Clarence River District—May.

T. WALDEN HANMER.

During the last few weeks the weather in the Clarence River District has been warm and showery, and the outlook for the winter is decidedly bright. Feed in all parts, except in isolated cases, has been fair all the summer, but water has been very scarce, and the prospect for the winter was gloomy. The recent rains have, however, altered the state of affairs, and each and all connected with dairying and agriculture have been greatly relieved, and swamps and waterholes are filled to overflowing. Despite the unfavourable season, just drawing to a close, old residents seem unanimous in declaring it to have been one of the worst ever experienced for the rapid growth of all kinds of weeds, and the weather, at the time of writing, continues to favour the growth of all kinds of rubbish, so that especial care should be taken by farmers to check their growth as much as they possibly can.

The present is a good month to sow wheat, oats, barley, rye, tares or vetches, lucerne, clover, rape, and grass seeds.

Wheat.—Specially favourable mention has been made by the writer of two varieties of wheat grown at the Grafton Experimental Farm during last season. They were a macaroni wheat called "Medeah," and the milling wheat "John Brown." They were recommended by the wheat experimentalist, Mr. Farrer, as likely to suit our peculiar district. Neither variety showed any sign of rust. Unfortunately, seed of the Medeah variety is very hard to obtain at present, but there is about one bushel on hand at the Grafton farm from which it is hoped a good yield of seed will be obtained for future use. The following varieties are to be tried this planting, as soon as the land can be got in order :—Farrer's Durum, F (RI) (erroneously called Beloturka), Cretan, Velvet Don, Kubanka. Results of these trials it is hoped will be published in the *Gazette* in due course.

Oats.—The following varieties we are going to try this season :—Ligomo, Great Northern, Abundance, Algerian, and Red Rust-proof.

Barley.— Skinless and Cape Barley seem to be the favourites.

Rye.—Emerald, White Rye, and Common Rye seem to be the best known, but the writer does not consider that rye is of much value as greenstuff for the milch cow. Except in rare instances, cattle do not appear to relish it to any extent. The straw is, of course, used by saddlers for stuffing collars, &c., and occasionally one comes across rye bread.

Tares or Vetches.—Black and Golden tares produce an excellent crop of greenstuff, and may be sown either by themselves or mixed with oats, barley, &c. If sown broadcast 1 to 1½ bushels to the acre are required, and oats or barley sown at the same time at the rate of three-quarters of a bushel to the acre will help to keep the tares off the ground, and make them yield better.

Lucerne.—Lucerne may be sown this month—in fact, many think May the best of all months to plant. Three new varieties are being experimented with at Grafton Experimental Farm, the seed having just been received from Algeria. They are:—No. 1, Lucerne of Pays; No. 2, Lucerne (Alfalfa, Spanish); No. 3, Lucerne of Poitou. We hope to publish results later.

Clover.—We recommend farmers to try a little patch of red clover. It is an excellent green fodder, makes good hay, and is very beneficial as a green manure. About 20 lb. will sow an acre.

Rape makes an excellent green food, and is also used as green manure. Sow at the rate of about 6 lb. per acre broadcast, or 4 lb. per acre if sown in drills.

Grass Seeds.—The autumn is the most favourable season for sowing all kinds of grass seeds, such as Prairie, Cocksfoot, Paspalum, &c.

Onions.—May and June are the best months to sow onions as a field-crop in this part of the State. About 5 lb. of seed will sow an acre in drills, 2 feet apart, and the seed covered lightly with a roller only.

Vegetables.—The following may be sown:—Peas, broad beans, cabbage, lettuce, turnips, parsnips, carrots, &c.

Fruit Trees.—Plant out all kinds of evergreen trees, such as oranges, lemons, &c.

OWING to the absence of officers from their respective farms, &c., attending the Royal Sydney Agricultural and other Shows, it was, unfortunately, impossible to obtain the usual notes from Wagga, Bathurst, Glen Innes, &c.

Crown Lands of New South Wales.

THE following areas will be available for selection on and after the dates mentioned:—

FOR CONDITIONAL PURCHASE LEASE.

C.P.L. No.	Name of Land District.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
8	Muswellbrook	acres. 1,533½	2	826½ acres and 707 acres.	Merriwa, 17 miles; Muswellbrook town and railway station, 65 miles.	£31 and £26 10s 3d., respectively	1906. 31 May.

Level, undulating, and hilly country, of basaltic formation; part deep black and chocolate soil, with patches of stony soil; about 315 acres suitable, when cleared, for cultivation of wheat, maize, hay, &c.; 982 acres good grazing, fit for dairying; balance steep slopes, partly stony, but fair grazing land.

C.P.L. No.	Name of Land District.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
9	Narrandera ...	......	1	614 acres ..	About 9 miles from Narrandera by first-class road.	£23 0s. 6d. ...	7 June

Level and undulating country, part open plain, loose dark-grey soil, reddish soil over clay subsoil; part rich sandy loam, lightly timbered with box, gum, and pine; good sheep country, 300 acres suitable for wheat growing.

FOR SETTLEMENT LEASE.

S.L. No.	Name of Land District.	Holding, &c.	No. of Farms.	Area of Farms.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
*830	Coonamble ...	.....	1	3,603 acres.	Quambone, 14 miles; Gular railway station, 30 miles.	£60 1s.	1906. 10 May.

Level, timbered, and plain country; sedimentary formation; soil—sandy, sandy loam, red loam, and black clay, clay subsoil; about 400 acres of open forest, timbered with budtha, wilga, and myall; about 2,700 acres of thick forest and scrub, timbered with box, pine, oak, belah, wilga, with wattle, pine and hopbush scrub; about 500 acres open plain. Water in Merri Merri Creek, but not permanent; can be stored by means of dams and surface tanks.

* Original applications only.

For Improvement Lease.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Upset Annual Rental per Block.	Date of Sale or Tender.

Central Division.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Upset Annual Rental per Block.	Date of Sale or Tender.
1376 and 1377	Parkes .	Goobang ..	acres. 8,250	2	acres. 4,125 each.	Village of Alectown, 5 miles; Town and Railway Station of Parkes, 16 miles.	£ s. d. 12 17 10 for each block.	1906. Sale. 21 May.

Mostly rough, broken, stony, gravelly ridges; about one-third is gravelly, interspersed with red loam soil, remainder is poor greyish soil, mostly hard, but a great deal rocky, stocky, and gravelly; about 100 acres could be cultivated; timber—chiefly ironbark and red pine, with heather, wattle, and spinifex; best land covered with silver wattle, pine and hopbush undergrowth; good facilities for water conservation; permanent spring within one block. Rainfall, about 24 inches per annum. Rabbits are numerous.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Upset Annual Rental per Block.	Date of Sale or Tender.
616	Wyalong .	Buddigower	....	1	4,850	Wyalong Town and Railway Station, 30 miles.	Inclusive of rent for use of Crown improvements.	Sale. 7 May.

Part level and gently undulating, and timbered with box, pine, and yarran forest, part rough and hilly, timbered chiefly with currawong, with some ironbark, stunted gum, and she-oak; red sandy loam soil. About 2,050 acres have been ringbarked, but through neglect a large growth of suckers and seedlings has sprung up. No natural water supply, but good facilities exist for conservation. Rainfall, about 17 inches per annum. Rabbits, wild dogs, and eaglehawks exist.

Eastern Division.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Upset Annual Rental per Block.	Date of Sale or Tender.
618	Armidale ..	Springmount.	....	1	120	Town and Railway Station of Black Mountain, 4 miles; City of Armidale, 15 miles.	1 0 0	.... ..

Undulating to hilly, stony country, mostly thickly timbered with stringybark, peppermint, white gum, and black oak, and about 2 acres plain (Fox-tail Swamp). Soil—white loam of slate formation. Water supply in Springmount Creek sufficient in all ordinary seasons.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Upset Annual Rental per Block.	Date of Sale or Tender.
621	Carcoar .	....	....	1	510	Newbridge Railway Station, 35 miles; Town of Tuena, ¾ mile; Village of Abercrombie, 1¼ miles.	4 5 0	Sale. 14 May.

Hilly and mountainous, none undulating or level, parts very broken; formation—slate with little limestone; soil—stony and gravelly throughout, soil deficient in parts; thick to open forest of white, red and yellow box, gum, apple, and stringybark, with some sapling undergrowth. Permanent and sufficient water supply in Tuena and Sam Hunt's Creeks. Rainfall, about 24 inches per annum. Rabbits exist.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Upset Annual Rental per Block.	Date of Sale or Tender.
626	Goulburn ..	....	....	1	300	Goulburn Railway Station, about 30 miles; Crookwell, about 9 miles.	15 0 0	Sale. 21 May.

Country thickly timbered with gum, with some peppermint, stringybark, and honeysuckle. Water is plentiful. Rabbits and foxes exist.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Upset Annual Rental per Block.	Date of Sale or Tender.
625	Mudgee	....	....	1	2,240	Cassilis, about 4 miles; Mudgee Railway Station, 46 miles.	18 13 4	Sale. 8 May.

Broken ridgy country of sandstone formation; timbered with ironbark, apple, gum, box, stringybark, pine, and a few oaks and currajong. Water permanent in Four-mile Creek, and in winter months in Ironbark Creek; fair facilities exist for conservation. Rabbits exist.

For Improvement Lease—*continued.*

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Upset Annual Rental per Block.	Date of Sale or Tender.
					acres.			1906.
622	Mudgee	......	......	1	880	Cassilis, about 22 miles; Mudgee Railway Station about 72 miles.	7 6 8	Sale. 7 May.

Strip of undulating tableland along west and north-west, and falling steeply to the Talbragar River; basaltic formation; permanent water in head of Talbragar River and mountain gullies. Timber gum, stringybark, apple, woollybutt, and black sallee.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Upset Annual Rental per Block.	Date of Sale or Tender.
616	Queanbeyan	Cotter Falls	......	1	11,280	Queanbeyan Railway Station, 30 miles.	11 15 0	Sale. 21 May.

The country is extremely rough and mountainous; the higher parts being very rocky, of granite formation; the lower hills being steep, of slate formation, with narrow flats along river of sandy and loamy soil; all thickly timbered with gum, messmate, mountain ash, and peppermint. Water plentiful and permanent. Native dogs are very numerous; there are a few rabbits and wallabies.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Upset Annual Rental per Block.	Date of Sale or Tender.
615	Singleton .	....	......	1	1,160	Town of Jerry's Plains, about 5 miles; Town and Railway Station of Singleton, about 17 miles.	4 16 8	Sale. 7 May.

Undulating to rough, steep, and broken country of sandstone formation, mostly gritty, gravelly, and stony soil; sandy on lower ground and a fair strip along south of portion 60, parish Wambo, county Hunter. Timber—oak, ironbark, gum (spotted and gray), box, pine, stringybark, and a few apple trees, with scrubs of oak, tea-tree, tallow-bush, currant-bush, blackthorn, brush, vines, grass tree, and prickly-year No natural permanent water supply, good facilities for conservation. Hares, wallabies, and dingoes exist.

For Original Conditional Purchase.

Name of Land District.	Name of Holding, &c.	Parish.	County.	Total Area.	Price per Acre.	Date available.
				a. r. p.	£ s. d.	1906.
*Gunnedah .	Within Boggabri suburban lands.	Boggabri .. .	Pottinger	43 2 15	4 0 0 and 5 0 0	17 May.

Good suburban residential sites; partly gravelly ridge, partly black soil flat; water obtainable by shallow sinking, and from Cox's Creek.

Name of Land District.	Name of Holding, &c.	Parish.	County.	Total Area.	Price per Acre.	Date available.
Lismore .	....	Hanging Rock ..	Rous .	434 0 0	1 10 0	24 May

Being portions 45 and 46; suitable for agriculture, dairying, &c.

Name of Land District.	Name of Holding, &c.	Parish.	County.	Total Area.	Price per Acre.	Date available.
Lismore ..	....	Nimbin ..	" ..	488 0 0	1 5 0	3 May.

Suitable for grazing, fruit-growing, &c., when cleared.

Name of Land District.	Name of Holding, &c.	Parish.	County.	Total Area.	Price per Acre.	Date available.
Maitland .	....	Corrabare .. .	Northumberland.	80 0 0	1 0 0	10 May.

Being portions 2 and 93.

Name of Land District.	Name of Holding, &c.	Parish.	County.	Total Area.	Price per Acre.	Date available.
*Tamworth .	Within Tamworth suburban lands.	Tamworth .. .	Inglis	19 1 34	10 0 0 to 60 0 0	17 May.

Elevated suburban residential sites, overlooking town of Tamworth.

Name of Land District.	Name of Holding, &c.	Parish.	County.	Total Area.	Price per Acre.	Date available.
*Young .	Within Young population area.	Young	Monteagle .	141 2 0	2 5 0	31 May.

Part suitable for cultivation, the balance good grazing land.

* Identical with Special Area, see page 531.

For Original Conditional Purchase or Conditional Lease.

Name of Land District.	Name of Holding, &c.	Parish.	County.	Total Area.	Price per Acre.	Date available.
				a. r. p.	£ s. d.	1906.
Barmedman ..	Lower Mithul Holding.	Yarranjerry ..	Bourke .	927 2 0	0 13 4	24 May
Being portions 13, 56, and 57; parts suitable for agriculture and grazing						
Coonabarrabran.	Gorah Holding .	Rundle	Baradine ..	1,000 0 0	0 16 8	3 May
Forbes	....	Bundaburrah ..	Forbes ..	184 0 0 190 0 0	1 6 8	21 June
Suitable for wheat-growing.						
Gosford . ..	....	Narrara and Cowan	Northumberland.	1,350 0 0	0 10 0	14 June
Small patches near Mooney Mooney and Flood's Creek suitable for cultivation; unsuitable for grazing.						
Grenfell .. .	Arramagong West Holding.	Weddin .. .	Monteagle .	250 0 0	1 3 4	14 June
Part suitable for wheat-growing, the remainder good grazing land; whole area suitable for dairying.						
Grenfell . ..	Euroka North Holding.	Euroka .	Bland .	277 0 0	1 5 0	31 May
Suitable for agriculture.						
Kempsey .	....	Yarrabandini ..	Dudley .	400 0 0	1 0 0	7 June
Frontage to Christmas Creek.						
Maitland .	....	Mulbring .	Northumberland.	180 2 0	1 0 0	10 May
Good grazing land, heavily timbered.						
Muswellbrook	....	Killoe	Brisbane	220 0 0	2 0 0	14 June
Suitable for wheat-growing: practically all arable land						
Nyngan	Canonbar Holding.	Daroubie	Oxley .	1,200 3 0	0 10 0	24 May
Being portions 34 to 37.						
Raymond Terrace.	....	Tamaree .	Gloucester .	302 3 0	1 0 0	10 May
Being portions 27, 48, and 50.						
Raymond Terrace.	....	Thornton . .	Gloucester .	200 0 0	1 0 0	10 May
Being portion 63.						
Raymond Terrace.	. . ..	Sutton	Gloucester	341 2 0	1 0 0	10 May
Being portions 26, 47, and 48.						
Scone	.. ..	Omadale	Durham	1,750 0 0	1 5 0	14 June
Mostly good sound grazing land, with sufficient natural water in Hunter River and intersecting creeks.						
Young .	. ...	Burrongong and Wilton.	Monteagle	350 0 0	2 0 0	14 June
Suitable for dairying or wheat-growing						
Young .. .	... .	Milong	Bland	210 3 0	2 10 0	7 June
Suitable for grazing or agriculture.						

For Conditional Purchase or Conditional Lease.

Name of Land District.	Name of Holding, &c.	Parish.	County.	Total Area.	Price per Acre.	Date available.
Grafton ..	Within Resumed Area 523 and on Sportsman's Creek.	Stuart . .	Clarence .	550 0 0	1 0 0	5 April
Picton .	.	Cooba .	Cook . ..	84 0 0	1 0 0	14 June
Suitable for grazing, and has frontage to Cox's River.						
Queanbeyan		Naas .	Cowley .	50 0 0	1 0 0	14 June
Tenterfield	. . .	Wunglebong .	Clive .	82 0 0	1 0 0	14 ,,

Special Areas.

Gunnedah Land District, within Boggabri suburban lands, 43 acres 2 roods 15 perches, in twelve portions, in parish Bogabri, county Pottinger; maximum area, 6 acres 2 roods 30 perches; minimum area, 1 acre 1 rood 33 perches; good residential sites, partly gravelly ridge, partly black-soil flat; water obtainable by shallow sinking and from Cox's Creek. Price, £4 and £5 per acre. Available for original applications only on 17th May, 1906.

Tamworth Land District, within Tamworth suburban lands, 19 acres 1 rood 34 perches, in eight portions, in parish Tamworth, county Inglis; maximum area, 6 acres; minimum area, 1 acre 2 roods 2 perches; elevated suburban residential sites overlooking the town of Tamworth. Price, £10 to £60 per acre. Available for original applications only on 17th May, 1906.

Kempsey Land District, within Gladstone population area, parish Kinchela, county Macquarie, 146½ acres; maximum area, 44 acres 1 rood; minimum area, 33 acres 1 rood 20 perches; distant 10 miles from Kempsey; good soil, partly reclaimed swamp and partly firm flat alluvial land; timbered with tea-tree, oak, gum, brushwood, &c.; unsuitable for fencing or building; water not permanent; can be obtained by sinking, but not of good quality. Price, £6 per acre. Available 31st May, 1906.

Young Land District, within Young population area, parish Young, county Monteagle, 141½ acres; maximum area, 141½ acres; minimum area, 40 acres; distant 6 miles from Young, granite country, good soil; timber—box and gum, now killed; a good proportion of the area is suitable for cultivation, the remainder is good grazing land; good water supply in gully; rainfall, 28 inches. Price, £2 5s. per acre. Available for original applications only on 31st May, 1906.

AGRICULTURAL SOCIETIES' SHOWS.

1906.

Society.	Secretary.	Date.
Wellington P., A., and H. Society	A. E. Rotton ...	May 1, 2, 3
Upper Manning A. and H. Association	Edw. Rye... ...	„ 3, 4
Moree P. and A. Society...	S. L. Cohen ...	„ 8, 9, 10
Hawkesbury District Agricultural Association ...	C. S. Guest ...	„ 10, 11, 12
Coonamble P. and A. Association	J. M. Rees ...	„ 15, 16, 17
Durham A. and H. Association, Dungog, postponed until	C. E. Grant . .	„ 16, 17
Cobar P. and A. Association	J. M. Scott ...	„ 30, 31
The Central Australian P. and A. Association, Bourke	G. W. Tull . .	June 6, 7
The Lachlan P. and A. Association	Thos. Cadell . .	July 20
Hay P. and A. Association	G. S. Camden ...	„ 26, 27
National A. and I. Association of Queensland ...	.. ..	Aug. 7 to 11
Forbes P., A., and H. Association	N. A. Read ...	„ 8, 9
Corowa P., A., and H. Society	H. L. Archer ..	„ 14, 15
Parkes P., A., and H. Association	G. W. Seaborne ..	„ 15, 16
Murrumbidgee P. and A. Association (Wagga) ...	A. F. D. White ...	„ 22, 23
Cootamundra A., P., and H. Association	T. Williams ...	„ 28, 29
Gunnedah Show	J. H. King ...	„ 28, 29, 30
Northern Agriculture Association (Singleton) ...	C. Poppenhagen ..	„ 29, 30, 31
Yass P. and A. Society	W. Thomson ...	Sept. 4, 5
Junee P., A., and I. Association	T. C. Humphrys...	„ 5, 6
Grenfell P., A., and H. Association	Geo. Cousins ..	„ 6, 7
Albury and Border P., A., and H. Society	W. J. Johnson ...	„ 11, 12, 13
Young P. and A. Association	Geo. S. Whiteman	„ 12, 13
Wyalong District P., A., and H. Association ...	S. G. Isaacs ...	„ 18, 19
Germanton P., A., and A. Society	Jas. S. Stewart ...	„ 19, 20
Temora P., A., H., and I.	W. H. Tubman . .	„ 25, 26
Lockhart A. and P. Society	R. O. Drummond	„ 26
Lismore A. and I. Society	T. M. Hewitt ...	Oct. 31 & Nov. 1

1907.

Albion Park A., H., and I. Society	H. Fryer... ...	Jan. 16, 17
Tenterfield Intercolonial P., A., and Mining Society...	F. W. Hoskin ...	Mar. 5, 6, 7

[Three Plates.]

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Agricultural Gazette of New South Wales.

William Farrer.

THE loss sustained by us through the sudden death from heart disease of William Farrer will be shared by all who are interested in the wheat question in every part of the world.

For the past twenty years Farrer has been engaged on the self-imposed task of the improvement of wheats, and though his aims were more immediately directed towards the satisfaction of local requirements, the thoroughness of his methods and the broad scope of his investigations have been productive of results of value to every wheat-producing country in the world.

William James Farrer was born on 3rd April, 1845, so that at the time of his death (16th April, 1906) he had just completed his 61st year.

His father was a country gentleman, living near Kendal, in Westmoreland, where he himself was born, and his family had been landowners in the district for several generations, belonging to a class known in Westmoreland and Cumberland as "statesmen."

Farrer was educated at Christ's Hospital (the "Bluecoat School"), and before leaving was one of the "Grecians," a name given to the boys in the highest form, and had distinguished himself by gaining a gold and a silver medal for mathematics.

After leaving the Bluecoat School he entered Pembroke College, Cambridge, where he graduated in 1868, obtaining a place among the Wranglers in the Mathematical Tripos of that year.

It was originally intended that he should have been called to the Bar, but his own tastes did not lie in that direction, and he determined to study for medicine, remaining about a year longer at Cambridge with this object.

This idea he was obliged shortly to abandon, on account of ill-health, and it was owing to lung trouble that he sailed for Australia about 1870. His intention had been to purchase a sheep station in New South Wales, and in order to gain colonial experience he first went as tutor to the family of the late George Campbell, of Duntroon Station, near Queanbeyan. About this time, however, loss of money in mining speculations caused him to abandon the idea of station life, and to become a surveyor.

He gained his field experience with Messrs. Licensed-Surveyors Wilkinson and Cummins, the latter in the Wagga district.

In July, 1875, he passed his examination for licensed surveyor, being placed third out of twenty-two candidates. Immediately after being licensed he was employed by the Lands Department on contract surveys in the Dubbo district, under District Surveyor Dalglish, until 1878, when he paid a short visit to England.

On his return (July, 1879) he was again employed by the Lands Department in the Dubbo district, and on the survey of the travelling stock route from Nyngan to Cobar, until 1885, when he accepted work under District Surveyor Sheaffe, in the Cooma district.

In July, 1886, he voluntarily resigned his connection with the Lands Department, and settled down at his home at Lambrigg, near Queanbeyan.

He had married (September, 1882) the daughter of the late Leopold Fane de Salis, of Cuppacumbalong Station, and a prominent member of the State Legislature.

It was now that he occupied his leisure in the pursuit of the hobby which engrossed the remainder of his life. In September, 1898, his services were engaged by Mr. Sydney Smith, then Minister for Mines and Agriculture, as Wheat Experimentalist, and he continued an active officer of the Department until the day of his death.

The reasons which induced Farrer to accept this position were the opportunities of extending his experiments under different conditions as to soil and climate which were afforded him by the various Experiment Farms, and the facilities for growing on a larger scale established varieties for distribution.

Of his personal character, it is difficult for anyone who knew him at all intimately to speak without danger of being accused of partisanship. Of a highly sensitive disposition, he was by nature extremely reserved and reticent towards comparative strangers. His health, which was always somewhat delicate, accentuated this characteristic, and the fact that he had to be particularly careful in the matter of food and surroundings caused him to be always somewhat chary about accepting hospitality. Those who knew him intimately will always preserve the memory of one of the most high-minded, generous, and unassuming of men.

Widely-read and of broad culture and sympathies, his conversation was always suggestive and invigorating, and it can be quite truly said of him that no one could enjoy an intimate conversation with him without feeling a better man.

His nature was generous and sympathetic in the extreme, and none, I am sure, ever applied to him for a favour which it was in his power to bestow without its being granted, or ever related a story of suffering without enlisting his active sympathy.

He was a fluent and ready writer, and a master of English prose, so that his letters and published writings were always delightful reading; and even his official minutes possessed some literary flavour. Simple and frugal in his personal habits, he was equally direct and straightforward in his habit of thought, and was incapable of anything like self-seeking.

It was his earnest desire to benefit humanity that induced him to devote the leisure period of his life to the task of the improvement of wheat, and to put himself once more into official harness at a comparatively advanced

age, in the hope of an extended field of activity and usefulness. It was this knowledge of the usefulness of the work he was doing that kept his enthusiasm undiminished to the end. He loved his work. He left it reluctantly at night, and looked forward eagerly to the morning that he might resume it.

Possessed by this untiring enthusiasm, he threw himself into his work with an energy that was quite remarkable. In the pursuit of the matter which he had in hand no labour was too exacting, no detail too insignificant. The work carried out by him on his private experiment station at Lambrigg was in itself sufficiently arduous. In addition to this, when he joined the Department of Agriculture, he supervised personally all the work done at the different farms under his direction, a task which involved the paying of periodical visits to distant parts of the State. Both the work itself, and the actual travelling, were often done under conditions sufficiently trying to have tested the endurance of a much younger and more robust man.

Though he did not live long enough to see all his ambitions realised, he lived, nevertheless, sufficiently long to enjoy the satisfaction of public and private appreciation of his work, both here and abroad. He was in correspondence with all the English and American institutions interested in the wheat question, and he exchanged new varieties with everyone, here and abroad, who possessed facilities for giving them a trial. A few years ago Mr. Moreland, Director of Agriculture for the North-west Provinces of India, paid a visit to Australia, under instructions from his Government, to study at first hand the methods adopted by Farrer, with a view of instituting research on similar lines in India.

The problem which he set himself was the systematic improvement of wheat by cross-breeding and selection, particularly in the direction of producing types which should resist our two principal scourges, rust and drought, and in the maintenance of a high milling standard, more especially in the production of strong-flour wheats.

By paying particular attention to this last point, Farrer has not only succeeded in maintaining a high milling standard in his cross-bred wheats, but has produced new varieties of much greater value to the miller than any that were previously in cultivation. One strong-flour variety, which he has named "Come-back," and which is rapidly becoming popular in South Australia, appears to be so well adapted to South Australian conditions, and to produce a flour of such high strength and quality, that the Adelaide millers are paying 4d. per bushel more for it than for the ordinary weak-flour grain. A variety known as "Bobs" is becoming a strong favourite with farmers and millers in New South Wales, on account of its resistance to rust and the strength of its flour. Of the success of the rust and drought resisting varieties it is still rather early to speak with any degree of finality. New varieties require a certain time to adapt themselves to different conditions, and many that resist rust quite successfully in one district may succumb to it in others. Then again, other rust-resistant varieties may possess qualities which render them unsuited to certain districts.

The question of the production of a payable wheat for the rainless west is also one which cannot be said to be definitely settled, though last season's experience at one of the experiment stations (Coolabah) with some of Farrer's cross-breds has produced surprising results, which indicate that the solution of the question is by no means impracticable.

The result of Farrer's life work is that we are now in the possession of certain strains of wheat which surpass those at present in general cultivation in certain characteristics which are of supreme importance to our conditions. As these conditions prevail not only with us, but also in many parts of the world, and as Farrer's cross-breds possess in addition the essential characteristics of being first-class milling wheats, it will be seen that his work is not merely of local but of world wide significance.

If the result of his work is to enable us to cultivate wheat in regions which are at present considered unsuited for it, either on account of low rainfall or liability to rust, an enormous additional area will be made available for wheat-growing, and the time when, according to some writers, all the available wheat-lands of the world are occupied will be yet further postponed.

It behoves us as a community to see to it that the good work begun by Farrer shall be continued in the spirit with which he conducted it.

It is given to few to realise the fulfilment of their life's endeavours, and the highest achievements of humanity are the result of the concerted efforts of generations of workers imbued with the same idea. The torch once kindled is passed on from hand to hand, revealing to each successive bearer new wonders in the surrounding darkness.

The community can do no more than encourage those engaged in this work of love; the individual must provide the labour, and reap the disappointments and the rewards. It is not too much to hope that amongst us there may be one or more imbued with Farrer's enthusiasm, his singleness of purpose, his patience and painstaking perseverance, so that the next generation may be in possession of improved varieties of wheat, of which we at present have no proper conception. Through Farrer's work, New South Wales, if it does not actually lead the world in the production of improved varieties, stands well in the front rank.

Let it be our care that it does not drop back into a more obscure position.

F. B. G.

Bibliography.

Articles contributed to the *Agricultural Gazette*.

	Volume.
"On Cross-breeding and Fertilizing Wheat" ... ... (This is an abstract of a letter addressed to the Department, suggesting their co-operation, which may be said to inaugurate the work subsequently done in conjunction with the Department.)	II, p. 452.
"On Crimson Clover" ... ... (An article reprinted from the "Garden and Field," to which it was originally contributed.)	IV, p. 859.

	Volume
"**The** ***Too*** **Common Crow**"	VIII, p. 4
"**The Making and Improvement of Wheats for Australian Conditions**"	IX, pp. 131, 241
(A paper read before the Sydney session of the Australasian Association for the Advancement of Science, 1898.)	
"**Notes on some of the Wheats which are in general cultivation in New South Wales**"...	X, pp. 410, 896.
"**How Experiment Farms can be made to help on in the best manner the Agriculture of the Country**"	XI, p. 142.
(A paper read before the Melbourne session of the Australasian Association for the Advancement of Science, 1900.)	
"**Manitoba Wheats**"	XI, 585.
"**Notes on the damage done to Wheat-crops by the late frosts in the Spring of 1899**"	XI, p. 675.
"**Some experiments in dealing with Bunt or the Stinking Smut of Wheat**"	XI, p. 335.
"**White Lammas and Purple Straw Wheats**"	XI, p. 25.
"**Results of Lambrigg Bunt-experiments, 1900**"	XII, p. 419.
"**Notes on Wheats offered for sale at Wagga**"	XII, p. 548.
"**Thick and thin seeding experiments carried on at Wagga Farm, 1900**"	XII, p. 1105.
"**Federation variety of Wheat**"	XIII, p. 977.
"**The effect on the milling quality and nutritive value of the resulting crop of wheat when bunt-infected seed is sown**"	XIII, p. 1094.
"**The absolute dependence of Agricultural Progress upon experiments, and suggestions in regard to some directions in which experimental work should be done for the Agriculture of Australia**"	XIII, p. 206.
(A paper read before the Hobart session of the Australasian Association for the Advancement of Science, 1902.)	
"**Note on Mr. Coleman's South Australian Wheat experiments**"	XIII, p. 388.
(Appendix to a paper by Mr. F. Coleman, giving results of experiments with wheats supplied to him by the Department.)	
"**Bunt Experiments of 1901**"	XIV, p. 206.
"**Macaroni Wheats**"	XIV, p. 1073.
"**Some notes on the Wheat 'Bobs,' its peculiarities, economic value and origin**"	XV, pp. 739 and 849.
"**Some notes from the Wheat Experimentalist**"	XVI, p. 262.
"**Some notes for wheat-growers, choice of varieties, selection of seed, treatment of seed for bunt, manuring, &c.**"	XVI, p. 462.
"**The effect, in actual Farm-practice, of treatment with Bluestone on the germination of wheat**"	XVI, p. 1246.
"**The effect of some solutions of Formalin and Bluestone, which are in common use, on the germination of wheat-seeds**" (in conjunction with G. L. Sutton) ...	XVI, p. 1248.
"**Wheats available for distribution**"	XVII, p. 282.
"**Field experiments with wheat at the Cowra Experiment Station Farm**" (in conjunction with G. L. Sutton)...	XVII, p. 311.

In addition to the above, which embody the results of his investigations, he contributed to the pages of the *Gazette* a number of notes, replies to correspondents, &c., some of which are of considerable length and interest. The references to these and to the Annual Reports will be found below.

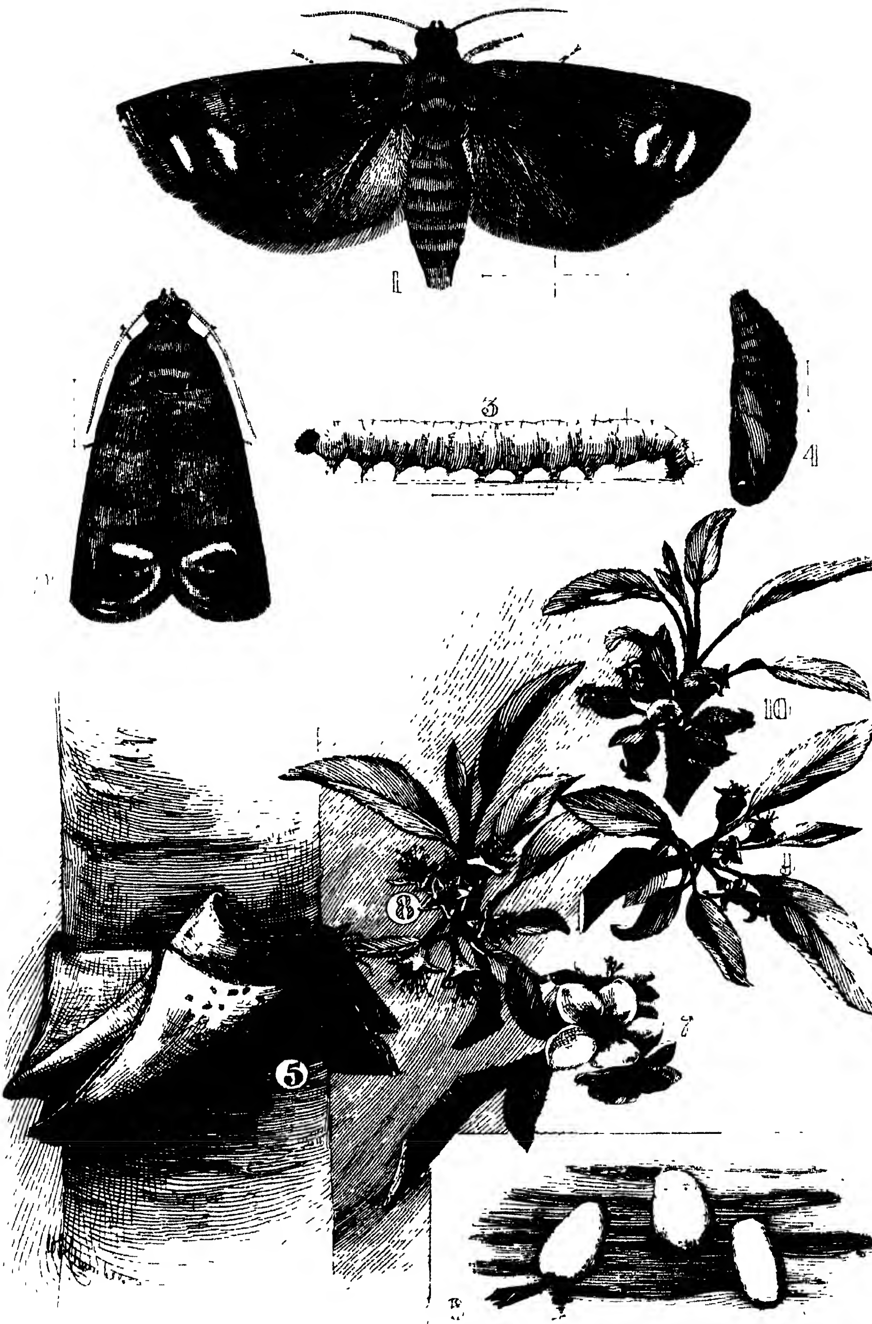
"Smut in wheat, and dry seasons"	X, p. 479.
"Spread of oats to wheat-land"	X, p. 480.
"Prevalence of Rust in Upper Colo"	X, p. 480.
"Wheats for Northern Table-land"	X, p. 480.
"Effects of Bluestone upon wheat in dry seasons"	X, p. 715.
"Take-all in wheat"	X, p. 716.
"Oats in wheat-paddocks"	X, p. 718.
"Fife-Indian Wheats"	X, p. 918.
"Effects of late frosts on wheat-crops"	XI, pp. 27 and 675.
"Poisoning Crows"	XI, p. 941.
"Destroying Crows"	XII, p. 515.
Annual Report for 1900	XII, p. 936.
"Bunt in self-sown wheat"	XII, p. 1182.
Annual Report for 1901	XIII, p. 537.
"Destruction of Sparrows"	XIV, p. 286.
Annual Report for 1902	XIV, p. 852
" " 1903	XV, p. 1047

Miscellaneous.

"Grass and Sheep-farming: A paper Speculative and Suggestive."
(Published by Wm. Maddock, Sydney, 1873.)

"Rust in Wheat."
(Appendix B to minutes of proceedings at a Conference of Delegates on Rust in Wheat, Melbourne, 1890.)

Papers and Reports read at the 2nd, 3rd, 4th, and 5th Rust in Wheat Conferences, held respectively, at Sydney, 1891; Adelaide, 1892; Brisbane, 1894; and Melbourne, 1896.



THE CODLIN MOTH

1. Moth. 2. Characteristic Attitude of Moth. 3. Larva. 4. Pupa. 5. Bandage raised, showing Cocoons. 6. Cocoons (natural size) and Pupa-case. 7. Blossom too early for Spraying. 8. Correct stage for Spraying. 9 and 10. Too late for Spraying.

The Codling Moth

(*Carpocapsa pomonella*, Linn.)

WALTER W. FROGGATT, F.L.S.,
Government Entomologist.

ORIGINALLY a native of Europe, the codling moth has spread all over the world, and there are now few countries where apples are grown in which this destructive pest is unknown. Wherever it becomes established it destroys a large percentage of the fruit, and in New South Wales, at the lowest calculation, half the apples grown are rendered unsaleable through its ravages. It probably existed in the apple orchards of the Romans, and codling moth was responsible for the wormy apples mentioned by Pliny and other writers 2,000 years ago. The first definite description of the moth, accompanied by quaint drawings, was published by the Dutch writer Goedaerdt in his *Metamorphosis Naturalis*, in 1635, and to it he gave the name "pear-eater." In 1747, the English writer Wilkes gave an account of its life-history, based chiefly upon Roesel's account, published the year before, but noteworthy for the fact that he christened it the "codling moth," after the codling or codlin (apple) tree upon which it fed. It had no scientific name until Linnæus included it in his *Systema Naturæ*, printed in 1758, and described it very briefly under the name of *Tinea pomonella*.

It was identified by Tuffs in America as the cause of wormy apples in 1817, and was recorded from Tasmania about fifty years ago, doing considerable damage to the apple crop in that country in 1857, and ten years later was noted in New Zealand. It is pretty evident that the mainland received its codling moths from Tasmania soon after the importation of apples commenced, as it was noticed in Victoria about 1885, in South Australia in 1885, in Sydney in 1887, and in Queensland in 1889. In the gardens about Bendigo, Victoria, up to 1885, to my knowledge, it was rare, if it existed, in apples and pears; but after an absence of ten years I found the old gardens full of grubs, both in the apples and pears.

So much has been written about codling moth that it is remarkable what a little original work in the way of field observations or original research has been carried on in Australia, for all our observers have been satisfied to quote the reports of other writers on the subject, without going into its habits under different conditions in Australia, so that nearly all that which has been written is based upon observations in other parts of the world. The only report upon experimental work on codling moth in Australia is that of Mr. George Quinn, of the Agricultural Bureau, of South Australia, "Spraying Tests for Codling Moth" (*Journal of Agriculture and Industry*, June, 1898), where the observer sprayed a block of trees and tabulated his results, but, unfortunately, the tests were not carried out in the following year.

The observations given in these notes are founded on careful observations carried out by myself, while working, in conjunction with Mr. W. J. Allen, the Fruit Expert, in a badly infested orchard in Mittagong, owned by the Rev. J. Dark, but leased to Mr. J. W. Thompson, who assisted the Fruit Expert in the spraying experiments carried out in the orchard.

These experiments were carried out for two years, and though the results were somewhat negative, through the windfalls in the last year's operations having been left to rot on the ground, and owing to the presence of unprotected stakes in the orchard at the critical time when the falling grubs were most plentiful; yet an immense amount of information was obtained as to the habits and life-history of the codling moth in all stages of its existence, which cannot fail to be of great value in checking the damage caused by the pest.

Life-history.

The first codling moths always emerge about the 1st of October, and numbers come out in the breeding cages during the first week of that month. In an ordinary season the apple trees are just coming into bloom at the same time, so that the conditions of the season regulate the arrival of the first moths with the opening of the blossoms. The moths that are emerging all through the month into the early days of October are produced from the last crop of grubs that went into winter quarters in April, May, and the early part of June of the preceding year, and have remained hidden in the caterpillar state until about a fortnight before the emergence of the moth. Most moth-caterpillars pupate as soon as they have spun their cocoons; but in the case of this species the creature remains in the larval state, enclosed in the cocoon, until a few weeks before the moth state, and is only a pupa for a brief space of time. This is a great advantage to the grubs, for if they are disturbed during their winter sleep they can move on and spin a fresh cocoon, whereas if they had attained to the pupal stage they would have been destroyed. As soon as the moths have paired, the female flies about among the blossoms, depositing her eggs singly upon the embryo fruit, sometimes in the calyx or eye of the flowers, and often upon the stalks and bark; but the instinct of the tiny new-born grub leads it to the eye of the fruit, where, in comparatively safe quarters, it feeds about for several days before it commences to bore its way into the fruit. As it feeds, it works its way down towards the pips, the little scar caused by its entry soon healing; but, as the grub increases in size, it generally bores a hole through the side before it emerges, and sometimes at the eye. But at this stage of its existence its presence can be generally detected by the dirty brown mass of excrement and castings on the eye or the side of the apple. If the apple does not fall before the grub is full grown, it spins a silken thread, on which it drops to the ground, and the first brood of caterpillars are falling with or dropping from the apples in the middle of December. In an ordinary warm summer the moths are emerging from

the chrysalids of this brood early in January, and are coming out till early in March, hardly any chrysalids being found under the bandages after the 5th of March.

Early in January the second brood of moths are laying their eggs upon the now half-grown apples, and, as the calyx is now closed over, they deposit them upon any portion of the apple, but frequently take advantage to place them where two apples are close to each other, or a dead leaf is in contact with the fruit. Sometimes two and even three grubs of this brood may be found in a single apple, though in the first, when the apples are much smaller, this seldom happens. From these eggs the second crop of caterpillars are produced. Early in February little patches of brown dust are noticeable upon the smooth skin of the apple, which, if removed and the surface sliced off, will reveal a little white codling moth-grub at work making his way downwards. These grubs are full grown in April, the later ones running into May; but no chrysalids were observed under the bandages after the middle of April. The caterpillars coming into maturity after that date remain in the larval or grub state, hiding thus through the winter. The advance guard of this second generation of caterpillars are captured under the bandages, but a great number come down in the windfalls, and the majority are carted away into the fruit-house, where many of them crawl out and spin their silken cocoons in the first suitable crevice they come across.

This proves that the first codling moths come out early in October, the eggs of which hatch out and produce the next brood of moths early in January, which lay eggs producing caterpillars that feed into the apples during February, and are full grown in March and April, none of which pupate after the first week in April, but, going into hiding, remain in the larval state until the middle of September, when they pupate and emerge a fortnight later.

The Description.

The egg is so small that it is not likely that the orchardist will be much interested in a description of it, and even in a badly-infested orchard I have looked over the wood of the trees for hours without finding a single specimen. The moth lays eggs, depositing them singly. The young caterpillar at first is dull white, with the thorax and head clouded with black; but as the caterpillar increases in size it becomes darker coloured, shaded with yellow and sometimes a tinge of pink; the two rows of black spots on the little ones become indistinct and the black markings of head and thorax brown. The adult caterpillar in the early part of the season spins a fine silken bag, either in the bandage or against the bark of the tree, but the latest ones generally pick out a depression in the bark, where they spin a very much stouter silken cocoon, covering the outside with particles of bark and dust, so that they are not so easily noticed as the former, while the stragglers, or last grubs of the season, do not spin a cocoon at all under the bandage.

Chrysalid.

Measures under half an inch in length, and is of a general reddish-brown colour, somewhat rounded at the head, with the wing case long, rounded, and reaching to the apex of the third abdominal segment; the dorsal surface of the abdominal segments ornamented with a double transverse band of fine stout spines, the lower one much smaller than the one above; the abdomen somewhat truncate at the tip.

Moth.

General colour light brown, with the tips of the fore wings mottled with rich metallic coppery tints forming a very distinctive rounded blotch; between this and the shoulder the wings are marbled with fine wavy grey bands thickest toward the tip; hind wings brown, with the thorax spotted with grey scales; length of outspread wings, 7½ lines. Most pictures of the codling moth are so much enlarged that they give a very false impression of the real insect, both in size and colouration. The moth is very seldom met with in the orchard, so it is scarcely remarkable that few orchardists know the codling moth by sight, even if shown specimens.

Methods of dealing with the Pest.

Scraping the Tree Trunk.

Most careful orchardists keep the rough bark scraped off the trunk and larger branches, and in an apple orchard where the trees are well grown, they are shedding bits of rough bark all through the growing season; therefore, if the trunks are scraped (an old butcher's knife makes a very good tool) before the bandaging commences, a very little trouble with the knife when killing the codling-moth grubs when taking off the bandages for examination will keep the trunks clean. White-washing the trunks is practised in many of the larger orchards, and this also helps to keep the trunks smooth, in killing all moss and lichens, and filling up small holes in the bark; but where the moth is really bad, I would also recommend the scraping of the loose bark, for if the limewash is badly made—full of lumps—and plastered all over the trees, as is sometimes done, it simply forms shelters for the grubs to pupate beneath.

Spraying.

This is the first process to deal with the codling moth; and with our present knowledge of the life-history of the moth, it is quite evident that the successful spraying of the open fruit calyx, or young fruit eyes, with Paris green will kill enormous numbers of the minute caterpillars when feeding on the poisoned skin of the young apple. The peculiar habit of most species of apples, in having the calyx open for some time after the petals fall from the flower (nine days in some varieties) renders it very easy to force the fine particles of Paris green held in suspension into the eye of each apple. Here, if there is no poison, the tiny grub, hardly noticeable with the naked eye, after feeding about, burrows down into the fruit, and can only be captured by destroying the infested apple.

If, on the other hand, the eye of the apple contains particles of poison adhering to the skin, the tiny grub eats them and dies before ever entering through the skin of the fruit. The spraying is therefore done to catch the young grubs before they penetrate the young apple, and thus every young apple that is successfully protected with Paris green, is safe from infestation by the first and most destructive brood of the grubs of the codling moth. The first spraying is far the most important, but the second one to catch the next brood should also kill a considerable number if sprayed evenly over the fruit. In his spraying experiments, Quinn sprayed some as many as seven times; but, from a study of the life-history, twice in the early part of the season, and a third time for the second brood of grubs, would be quite as effective. Spraying lightly is most successful, for if the trees are sprayed until the liquid runs, it generally carries the Paris green out with it; and on leaves where the spray has fallen, placed under the microscope, the lime will show a white line with an inner green band where the moisture has dried away. If more had fallen, the spray would have gravitated to the edge of the leaf, leaving nearly the whole surface free from poison.

Within the last few years, arsenite of soda has been used in many of the larger orchards with very good results. Mr. George Quinn, Chief Inspector in South Australia, says: "The field regulations have fallen into abeyance because our growers have had such wonderful success, and have so unanimously adopted the use of arsenite of soda in lime-water spray (Kedzie's Compound) that we no longer consider it necessary to insist on the bandaging, &c., though many still adopt the practice, purely on their own account as an auxiliary method of prevention."

I have seen this mixture used at Orange to destroy "pear or cherry slug," the slimy caterpillar of the little black saw-fly that feeds upon the epidermis of the leaves. As soon as the tree was sprayed, one could see the grubs falling off the foliage just as if they had been scalded. The action upon their slimy bodies was instantaneous. In this case it was a contact poison: when used on the codling-moth infested trees it is a stomach or internal poison, though in the case of damp foliage the poison on the freshly-hatched baby codling moth might also act externally.

Arsenite of soda formula recommended by the Departments of Agriculture is as follows:—

White arsenic	1 lb.
Washing soda	2 ,,
Water	1 gallon.

The arsenic and washing soda are boiled in the water until dissolved, and a pint of this stock solution is added to 40 or 50 gallons of water, in which 6 to 8 lb. of fresh slacked lime has been dissolved. So that the whole stock will make from 320 to 400 gallons of spraying wash, adding lime in proportion as the mixture is diluted.

It might be pointed out that 1 lb. 7 oz. of washing soda is sufficient to dissolve 1 lb. of white arsenic; but experience has shown that the additional soda makes it more effective. The lime is added to check the

burning properties of the arsenic upon the tissue of the leaves, arsenic alone, even in minute quantities, having a very caustic action on all plant life.

In America, washing soda (carbonate of soda) is often called sal soda, or crystal sal soda, in contradistinction to dry sal soda, which is the first reduced to a dry powder, and thus stronger. This is one of the cheapest sprays that can be used, and if the formula is carefully followed, there is less danger of damaging the foliage than with Paris green.

In the large orchards in the United States, where the trees are well grown, properly looked after, and sprayed regularly with this spray, bandaging is not done; but in young orchards where spraying is not started, or very old orchards, it is found necessary. Simpson (United States Department of Agriculture, Div. Entomology, *Bulletin* No. 41) states that in the orchards of Idaho, where his experiments were carried out in 1902, four sprayings were done, and no bandaging, with wonderful results.

The difference in our harvesting of apples is that in this part of America they are gathering their ripe fruit when our trees are just coming into flower in October.

Bandaging.

The importance of a proper bandage upon every apple-tree in an infested orchard cannot be too strongly advocated, for there seems to be a general impression among a certain class of orchardists that anything will do for a bandage—a bit of old bagging, an old stocking, or a sheet of newspaper being often used, sometimes just hung on to the tree trunk, dragging on the ground, or at other times half way up the trunk. Sometimes the bandage does not meet by several inches, and many bandages are simply tied round the tree and never removed or looked at all through the season, and are simply secure breeding grounds for the moths. In the first place, a codling moth bandage is not placed round the trunk of a tree to keep the caterpillar from crawling up, but to make a pleasant place of residence for him until we can attend to him; and in making this trap it should be as attractive as possible, for the more inducement that you hold out to him to come under its shelter, the better the catch will be. In the material used, cheese cloth, I found a close, soft, and still thin material, that, when doubled, and again doubled downwards after it was tied round the centre, formed an admirable home, while the stout binder twine also was very attractive, as many as seventeen grubs having been found in a tie before the bandage was removed, and for this reason I prefer it to the wire tie. Cheese cloth has the advantage over ordinary bagging, that the grubs do not burrow into it; and when it is unfolded every grub can be seen and killed, and it is a great thing to be able to see and kill every grub as you unfold the bandage. If you replace the bandage with a single grub or pupæ uninjured in its folds, you are nullifying the greater part of your labour.

Many popular writers advocate the use of two lots of bandages, taking one set off, dipping them into a tub of boiling water, and putting on a

clean one, to be removed in the same manner on the next inspection. This method might be a little quicker, but at the height of the grub season a careless operator would lose half the grubs, and the most careful would leave those that were imbedded in the tree trunk, and not attached to the bandage, and the perfect chrysalids would tumble out of the inner surface of the folds. All those thus left behind would have a better chance of emerging than those at large, for they would be nearer maturity. If the operator would destroy every grub, he must be armed with a stout pocket-knife and go to work systematically, first turning back the downward fold, killing the grubs in the band, and then unfolding the band, killing as he goes along. When the bandage is unwound he will scrape off all the loose grubs and cocoons on the bark, and then spreading the bandage, opened out, kill all the inside grubs, as they will be found all through it, and, turning it inside out, replace it on the tree trunk. This reads like a rather long process, but even where the grubs count up to forty or fifty under a bandage, it is wonderful how expert a person can become, and how quickly a tree can be cleaned. The bandage must be tied tightly, or else it gets loose and the grubs crawl under it up to the branches, where they are safe from capture; and it should be placed low down on the trunk, just clear of the ground, because if the stem is cracked or covered with rough bark, all the portion below the blanket will be full of grubs which have found harbour before reaching the shelter provided, and the exposed portion will have to be scraped over every time the bandages are examined.

Some writers have recommended double bandages round the tree trunk at an interval of a foot or two, but this is not practicable on trees with short barrels, and entails double work, without, I think, any corresponding advantages. If two bandages are put on a tree, you will always find some grubs in the upper bandage, but most of these, I think, have arrived at the upper bandage by crawling *downward*, and if it had not been there, would have been hidden in the lower one. If the bandage is properly made, and overlaps at the ends, it will take all the codling moth grubs crawling upward for shelter, except a few, probably not quite mature, that would not stop in any bandage. I have no actual proof for this statement; but on a large, straggling tree some of the grubs that leave the apples before they fall and drop on a thread must fall on the lower branches, and naturally crawl down for suitable camping places. I believe that every codling moth grub which falls to the ground, in the first instance, makes back to the trunk of the tree for shelter, and arrives there if it does not find an old stake or other shelter before it reaches its goal; therefore, the clearer the ground, the better the chance of collecting them on the trunk of the tree. The danger of unbandaged stakes and props, often used by orchardists when the apples are bending down the branches, to keep them from breaking down with the weight of fruit, is very great, for every pole is highway for the little grubs to regain the tree without being trapped in the bandage; and when once a grub gets back into the head of a large tree, good-bye to the chance of catching him.

I have taken as many grubs on a bandage round a slender prop as on the trunk of a big tree.

In the case of a new, well-laid-out orchard, where the trees have been properly pruned, and the stems are smooth and clean, there is no shelter on the tree above ground for the codling moth grubs, so that they are forced to seek the shelter of the bandage, and are easily captured. We find, however, in some cases that the grubs sometimes, failing more suitable hiding places, bury themselves in the soil, resting against the tree stem, level with the surface; and though they are subject to many dangers, if not attended to some will doubtless emerge in due season. Mr. Wolstenholme has been experimenting at our Bathurst orchard this year, banking-up the soil round the tree trunks for 5 or 6 inches, and beating it down hard with a spade, so that when the full-fledged moth emerges beneath the added soil she is unable to work her way out, and dies in the attempt. This experiment is worthy of imitation where the soil is loose and friable; but in hard, clay soil it would be difficult to make it moth-proof.

There are, however, so many orchards containing apple trees in all stages of disease and decay that are regular breeding-grounds for all kinds of disease, particularly in the coastal districts, that with the utmost care, and full attention to bandaging the trees, many would escape, and one would find cavities in the main trunk and branches packed with pupæ or hibernating grubs.

A number of owners of mixed orchards in the county of Cumberland are very much against compulsory spraying for codling moth, and favour legislation that would only enforce the bandaging of the trees and the collecting and destruction of all wind-falls and waste fruit. In a young orchard started on proper lines, and kept up to the mark, if bandaging was universal this might be sufficient; but in the old orchards would certainly not reduce the moth as rapidly as if carried on conjointly with spraying. It must always be borne in mind that there are an immense number of mixed orchards in such a state, from various causes, that the owners cannot expect to clear off codling moth in even two or three years; but they would soon find the good results that would accrue from a systematic crusade against it with up-to-date methods.

Perhaps the most important of all is the constant gathering of every damaged fruit showing the least sign of codling moth grub, with the destruction of these thus gathered together with all wind-falls.

The Fruit or Packing House.

The orchardist may both bandage and spray without making much impression upon this pest if he does not look after the infested apples brought into the fruit-house during the end of the season, for the bulk of the grubs, as soon as they are mature, will crawl out of the stored fruit, and hide on the rubbish about the floor, in the walls of the building, where, protected from both the weather and their many natural enemies, they have a far greater chance of reaching the adult stage than if they had remained in the field. A careful orchardist should construct his fruit-

house so that nothing can get out when the doors are closed, and the windows if fitted with wire gauze would attract the moths as they emerge. One South Australian orchardist recently stated that he took 4,000 moths in the windows of his fruit-house early in the season; and as each moth, counting half as females, can lay up to eighty eggs, 18,000 grubs could have been propagated from this single centre. It would be much better, when the fruit-packing house is open, and temporarily constructed of bark and brush, to burn it down after the season is over than to allow it to remain a centre of infection for the whole orchard. Where the fruit and packing house is a properly-built structure, with close floor, doors, &c., it would be very easy to clean up after the packing; fumigate the rooms with hydrocyanic gas, and keep the place sealed-up when the codling moth season commenced.

Wind-falls and Picking off Damaged Apples.

Where codling moth exists, no wind-falls should be allowed to lie about on the ground, for there is always a percentage of them containing the larvæ of the moth. In a large orchard, a number of barrels distributed among the trees, each provided with a bag and hoop, so that they can be securely closed up, could be used as receptacles for gathering together the wind-falls, and they could be then carted out and boiled, or otherwise treated for pig feed or other purposes. The barrels and bags should then be scalded to catch the ones that had crawled out or pupated. If the orchardist carried a bag round with him when thinning or working his trees, and picked off all the damaged apples and consigned them to the receiving barrels, he would gradually bring down the number of worm-eaten apples in his orchard, and thus in most cases improve the quality of the remaining apples. All stakes round trees should be removed as soon as the trees are well grown, as they are favourite haunts for wandering codling moths. Props, when used for holding up the branches, should be smooth, clean, and barked, when they can be as carefully bandaged and examined as the tree trunks. When the lessee of an orchard I inspected removed the stakes he had used as props, he stacked them just outside the orchard, where I noticed several had bandages still on them; and on opening one, found it contained thirty-eight grubs under the old bandage, and others in the cracks of the wood. As other stakes in the pile were covered with bark, they doubtless contained as many more.

How the Moth is Spread.

In the first instance, nearly every district has been infested by codling moth from the use and introduction of second-hand fruit-cases. The caterpillars in the apples when packed come to maturity, and crawling out of the fruit, make their way to the case, where they spin their cocoons in the first suitable crack. If it is late in the season, they may remain hidden for months in empty cases, which in the meantime are travelling all over the country, and may be finally dumped down anywhere, hundreds of miles from the original point of departure. It is no uncommon thing

to see empty fruit-cases, bearing well-known Ryde and Parramatta names, piled up in heaps at fruit depôts and hawkers' shops all over the northern rivers and the western towns. There is not the least doubt that more diseases in orchards are carried about and introduced into clean districts by the return or distribution of fruit-cases than in any other way; and the only way that they can be dealt with is after the manner of the South Australian Government in having all returned empties scalded before they enter the orchard.

Parasites.

The parasites of codling moth have been dealt with in my paper published in the March (1906) number of the *Agricultural Gazette*, so there is nothing more to add to the question in this reprint.

Legislation in other States regarding Codling Moth.

Tasmania was the first colony to pass a Codling Moth Act, in 1887. This was amended by the "Codling Moth Act, 1888," which in turn was abrogated by "An Act to amend the Codling Moth Act 1888 and for other purposes," 23rd December, 1891. This was again amended by "An Act to further amend the Codling Moth Act of 1888," 18th October, 1900. In Tasmania this Act is administered by Fruit Boards, the members of which, seven in number, are elected by the fruit-growers of the district. These boards have power to levy a tax up to 4s. an acre upon all orchards to carry out the provisions of the Act, appoint inspectors, &c.

The most important sections are as follows:—

"No person shall convey a case or permit to be conveyed into any part of the colony to another part of the colony, or from one part of the colony to another part of the colony of any fruit infected with the moth, or any case, box, barrel, bag, or other receptacle, containing the moth or any infected fruit, or which has at any time contained any infected fruit, unless the same has been previously cleansed in accordance with the regulations made under this Act, or otherwise to the satisfaction of an inspector; and if any person offends against this provision he shall be liable to a penalty of not less than ten shillings and not exceeding ten pounds."

"The occupier of every orchard in which no moth or no infected tree or fruit has previously been found shall, upon discovery or becoming aware of the presence of the moth or any infected tree or fruit therein, give notice to an inspector or to the Board of such orchard being so infected, and every such occupier who fails or neglects in any such case as aforesaid to give such notice as aforesaid shall forfeit and pay a penalty not exceeding five pounds for such offence."

"No person shall convey into any part of the colony any fruit infected with the moth, or any case, box, barrel, bag, or other receptacle containing the moth or any infected fruit, or which has at any time contained any infected fruit, unless the same has been previously cleansed in accordance with the regulations made under this Act, or otherwise

to the satisfaction of an inspector; and if any person offends against this provision he shall be liable to a penalty not exceeding ten pounds."

"Every person who sells or offers or exposes for sale any fruit infected with the moth shall be liable to a penalty not exceeding ten pounds."

Tasmania is mapped out into thirty fruit districts, which are managed by their local boards.

South Australia.

The Vine, Fruit, and Vegetable Protection Act, 1885, gives an inspector power to visit and enter any orchard or garden he considers is infested with codling moth; and after he has inspected it and found the pest, he serves the occupier with a printed notice, instructing him to take the following precautions, until he is notified that the garden is free from codling moth:—Scrape the trees; bandage them: remove such bandages at certain stated intervals; keep the ground free of rubbish; and "gather weekly all fruit affected by the codling moth that shall fall from any tree growing in such affected garden, and destroy such fruit or treat the same in a manner approved of by an inspector, that all larvæ therein or thereon shall be destroyed." Upon the back of this notice the Codling Moth Regulations are printed for the information of the occupier. Anyone obstructing an inspector is liable on conviction to a penalty not exceeding £50.

Victoria.

The regulations framed under "The Vegetation Diseases Act, 1896," are very similar to those of South Australia, and give inspectors power to enter and inspect orchards for codling moth, and give the occupier instructions how to deal with the pest. Under these regulations the State was divided into ten districts, to be managed by a board of seven fruit-growers living in the district; but latterly most of these boards have resigned or ceased to exist, and the inspectors receive their instructions from head office.

Queensland.

The codling moth is not specially dealt with in "The Diseases of Plants Act of 1896," but under the regulation full powers are given inspectors to enter orchards and instruct the occupier to treat any disease, and no nurseryman is allowed to remove plants that are diseased from one part of the State to another.

West Australia.

There is no special mention of the codling moth in the "Insect Pest Amendment Act, 1898," but in section 6—"Every occupier of any orchard in which any disease appears shall, within twenty-four hours after first discovering, or becoming aware of its presence, give written notice thereof to the Secretary of Agriculture, at Perth." Inspectors are appointed under this Act, and under the regulations every owner or occupier of orchards, vineyards, and nurseries, has to register his place, with a registration fee of 2s. 6d. for an area of one acre or under, and 5s. for an area exceeding one acre.

State Viticultural Station, Howlong

Some Results of the Experiments with European Grape-vines grafted on Phylloxera Resistant Stocks.

M. BLUNNO.

When the vine-growing industry is threatened with extinction in any district by the presence of phylloxera, the question of how to check the progress or

Red Hannapoort, on Resistant Stock.
Mr. Richardson's Vineyard, Camden.

counteract by all known and available means the relentlessness of the scourge arises to one of national policy. Thus we have seen this Department

pursuing for upwards of twenty years the eradication of infected vineyards, under regulations the stringency of which was, as far as possible, made compatible with local circumstances. The system was considered too drastic by some, while not a few opposed it in every possible way, so encroaching not a little on the action of the Government. What happened in other countries was

Mrs. Pearson's Golden Queen, on Resistant Stock.
Mr. Richardson's Vineyard, Camden.

a lesson not lost to this Department, which at least entertained one sanguine hope of stamping out the disease; and the drastic measures were followed for a score of years with the view of circumventing it, in which it has fairly succeeded. When we compare the harm done by this plague with the

devastation caused in other countries during the same period of twenty years, my contention will find justification, and we need not go as far as Europe to find a State to take for comparison.

Phylloxera is an infectious disease of the vine, but, unlike most of the contagions to which animal life is liable and plants in general are exposed to, through a number of fungi, has one great aggravating characteristic, inasmuch as its spreading suffers no abatement by the occurrence of climatic or other circumstances unfavourable to the agent of the disease, while they may be

White Hannapoort, on Resistant Stock.
Mr. Richardson's Vineyard, Camden.

benign to the general health of animals or plants. Phylloxera, as previously mentioned, is a relentless foe, suffers neither abatement nor is its course marked by recrudescence. Once it gains a foothold it is always on the increase, continuing at a rate which is in direct ratio to the ground already gained. The eminent Italian clinic, Guido Baccelli, at a conference on the tuberculosis of man, thought he could not better epitomize figuratively this scourge afflicting humanity than by calling it the phylloxera of human life.

After twenty years of war waged by this Department against phylloxera, the only human success that could be attained was attained, in so far the pest has been encircled, within a very small zone of the vine-growing territory. The gradual yearly increase of the expenditure of public money to obtain that success, while not being so very extraordinary, had all the same become disproportionate, and, other means being available to alleviate the distress, means less burdensome to the State, for which the intelligent co-operation of the growers is called upon to work their own salvation—now, I say, the twenty years of strenuous work done by the Department, solely for the benefit of the vine-growing industry, can be looked upon with equanimity. Phylloxera has but remained a thorn and a source of continuous danger within, but has not played such disastrous havoc that was caused elsewhere in an equal period. An outbreak of this disease possibly is imminent in the Riverina district, north of the Murray; but the contagion will work from

Temporano on Rupestris du Lot.
Viticultural Station, Howlong.

without this State—a circumstance over which we have no control, as the attempt made by this Department for an interstate concerted action against the spreading of this plague, on somewhat the same lines as the Berne Convention regulating the same matter in Europe, has failed.

In March, April, May, and June, 1904, numbers of the *Gazette* I contributed a retrospect of the question of phylloxera-resistant stocks in Europe, and also examined the actual position of some of the principal vine-growing districts there. In other articles and reports I related all that had so far been done in this State for the last six years, following a like course, which culminated in the establishment of a special viticultural station, where resistant stocks are raised for distribution among those growers whose vineyards have been destroyed by the disease, or for the planting of new ones within the infested area or in places much exposed to its visitation.

After providing for a permanent supply of resistant stocks, as many experiment blocks were established as there are kinds of stocks that have proved all along successful in the European vine districts, and also with a number of those which have so far given in that country varied results under varied circumstances. With the exception of a small patch of sandy soil, the ground in which the mother stocks are planted as well as where the experiments are conducted, is generally stiff, sets hard in summer, very lumpy, and, taken all round, is fairly representative of the class of soil, as far as texture goes, which we find under vines in several districts of the county of Cumberland, and in many places in the Riverina vine districts.

Dorradilla, on Resistant Stock.
Mr. Richardson's Vineyard, Camden.

It is generally known that in the county of Cumberland soil is hand-trenched from 18 to 20 inches before the vines are planted. The vineyard at the Viticultural Station on the contrary, was not hand-trenched, but only ploughed and subsoiled to a depth of from 17 to 18 inches. In May, 1899, the first start was made. The ground was cleared of its green timber, ploughed, subsoiled, cross-ploughed, rolled, harrowed, and the mother stocks planted along with the vines which were to serve as experiments. I may mention that the planting was finished some time in November of that year. The planting, therefore, was done under peculiarly adverse circumstances, and in such a hurry that it might be compared to that of a vigneron depending for his livelihood on his vineyard solely, who one fine morning awakes to find

two-thirds of his vineyard utterly destroyed, and sets at once to clear new bush land, and plants a vineyard the same season so as not to lose a year.

White Sherry on Riparia.
Mr. Bruckhauser's Vineyard, Camden.

The State Viticultural Station is much exposed to hot winds, a plague of cut-worms have been most destructive to the young grafted vines, and rabbits sometimes have caused great havoc among some of the experiment blocks. These vermin prefer the tender foliage of the European vines to the

foliage of the phylloxera-resistant mother stocks. To improve the texture and supply the soil with nitrogen, a crop of peas was sown in April, and ploughed in each September from 1900 to 1905, and as to mineral or other fertilisers we have used sparingly, seeing that the vines in general were growing better than we had anticipated. The ground was regularly ploughed and scarified at the usual times.

The vines are trained on wire. One or two canes are left which are renewed every year, for which purpose one or two spurs are also left. The vines are 8 feet apart in the row and 10 feet between the rows, which distance gives 537 plants per acre.

To give some idea of the success that has been achieved by private vine-growers in reconstructing their devastated vineyards with phylloxera-resistant stocks, several illustrations are given of vineyards in the vicinity of

Mr. Dummett's Vineyard, showing ravages of Phylloxera.

Smithfield and Camden. In one view the new plantation shows healthy and satisfactory growth, while 12 feet away the old phylloxera-infested dead or dying stocks can be seen. Better proof of the satisfactory progress made in combating this dread disease is hardly called for.

The following tables, giving the first instalments of data relative to the experiments that are carried on at the State Viticultural Station, Howlong, to find out the practical and relative affinity between the principal varieties of wine-grapes grown in this State, also the raisin-grapes, and the principal types of phylloxera-resistant stocks.

In my article on "Phylloxera-resistant Stocks," published in the *Gazette* of April, 1904, I gave the definition of affinity as the close and intimate relation existing between two subjects united by the graft, which relation is borne out by the readiness and thoroughness with which all the stocks of

the same kind graft with all the scions of the same variety of European vine, not only under one set of natural circumstances, but under all conditions of soil, and principally shown by the constant and regular bearing of satisfactory crops and the longevity of the grafted vines.

I consider that a European vine has a practical affinity for a kind of resistant stocks, when the yield of the grafted vine is good in quality, even if it should be only fair in quantity, and that, irrespective of the quantity of grapes produced by the same European vine not grafted. The relative affinity is the comparative average crop considered for quantity and quality for a number of years yielded by the same variety not grafted and grafted on the phylloxera-resistant stocks.

The grapes mentioned in each table have respectively been grafted on the kind of phylloxera-resistant stocks named at the top of the table, while the word "witness" following each name of the variety means the same variety immediately above but not grafted. The progressive numbers, from 1 to 18,

Mr. Dummett's Reconstructed Vineyard, on Phylloxera-resistant Stock.

indicate the order in which they are planted in the experiment block, while the missing numbers refer to table-grape varieties which, for the present, are not included in these experiments. In the left-hand column are reported the respective yields obtained in 1904. For this no analysis of the principal ingredients of the grape-juice was made. Such work requires the stationing of an analyst for, at least, a month at vintage time, and during that time the writer has many calls; however, by the following season an assistant to the œnologic laboratory having been appointed in the person of Mr. A. Musso, he was detailed for this work. The analyses were made at the Viticulture Station. Grapes were picked when it was thought they had reached a fair state of ripening, and, naturally, the grafted variety and the corresponding witness were analysed on the same day. The yields of the vines experimented with are calculated at the rate per acre.

In 1904 no records were taken of the yields of the experiments carried out on the Rupestris Martin, on Rupestris Metallica, and on the Franco-

American hybrids, viz., Cabernet x Rupestris No. 33, Mourvédre x Rupestris No. 1,202, because the vines were not yet properly in bearing. In 1905 it was intended to record the yields, but birds have so damaged the crop that I thought it better not to calculate the quantities; but only make the analysis, as enough grapes had been saved from birds to serve for this purpose.

In my articles on wine-making, I wrote at length as to acids and sugar in grape-juice, and I need not give any further explanation as to their meaning and importance. Vignerons usually estimate the percentage of sugar in their grapes with a saccharometer, Keen's being the most popular. Readings of this, Guyot's, and of the densimeter by Salleron have been taken, and are compared with the data obtained by making a proper chemical estimation of

Mr. Bruckhauser's Vineyard, on Resistant Stock, Camden.

the sugar with Fehling's standard liquor. It will be seen that the readings of Keen's saccharometer are the nearest to the results obtained through the chemical analysis. Polarimetric determinations were also made of the grape juice after the usual treatment with basic lead acetate and the proportion of glucose and levulose calculated.

The common belief is that sugar in grapes is composed of two equal quantities of destrose and levulose. Recent studies on fermentation have also shown that the yeast acts upon the destrose first; and after having split up this, it acts upon the levulose, consequently any trace of sugar left in wine after fermentation would mainly be constituted of levulose.

The estimation by the polarimeter of dextrose and levulose, the union of which form what is commonly called grape-sugar, so far show that the proportion of levulose is slightly higher than that of the dextrose. This fact is almost constant through the various samples of grapes whether cropped on vines growing on their own roots, or on vines grafted on

phylloxera-resistant stocks. As far as I know, no research in this direction has anywhere ever been made, and, I think, what we have found is worth knowing.

For the grower, the principal figures are those contained in the columns recording yield, acidity and sugar contents of the musts, on which I need not comment. My readers can peruse the tables at their leisure, only I wish to warn them not to precipitate a definite conclusion as to the suitability of the various stocks and the respective varieties of grape vines grafted upon them. Two years of experiments are not enough to decide a question of this kind; but this much may be said already, not that we ever doubted it, but rather in reply to the opponents to the resistant stocks, if any opponents are left. That is, that the yields may vary sometimes in favour of the grafted vines, sometimes in favour of those not grafted; but there is a certain constancy in the principal ingredients of the grape-juice of the vines worked on resistant stocks, viz., acids and grape sugar are found in suitable proportion for producing very good wines.

There have been two or three attempts to belittle the value of phylloxera-resistant stocks. In each case it was alleged that these stocks were easier prey to the parasite than the ordinary vines, having failed five or six months after they were planted. I went out to personally examine the stocks in question, and found that in two cases they had failed to grow because of the continued dry seasons. The third case was that of a number of stocks grafted some five years ago which are not looking at all vigorous now. Having had five or six of these vines dug out, and having carefully examined the roots, no trace of phylloxera was to be seen, therefore the pest cannot be the agent of the failure as alleged. An examination of the graft showed, on the contrary, that stock and scion had not properly joined, the tissues had not properly knitted together to form a sound, flawless stem, but they were held together by a spongeous, soft. scurfy, and anything but healthy growth. It was evident that those grafts had not been properly done, and a bad graft may be compared to a compound fracture of a broken leg which an unskilled surgeon did not properly set. The bone surfaces of the fractured limb either never unite or the new tissues never harden properly, leading then to a number of complications which permanently impair the limb, and in time bring more serious troubles. Stock and scion cannot grow together if a neglected wound is allowed to degenerate into a festering sore, which by degrees becomes a gaping cancerous black cavity occupying half, if not more, of what should have been fresh, sappy, fibro-vascolar tissues. I split some of the grafted stems, and cut others across, and unfailingly found that stock and scion were barely held together by a peripherical layer of live tissues, not quite encircling one-third of the stem, and not deeper than a third of its diameter. To further corroborate my view I asked complainant to dig up any grafted vine that looked vigorous, and had borne good fruit. We examined the zone of the graft and found it well healed and healthy all through. Anyhow, alongside these grafted vines are a number of vines not grafted, some of which have failed, while others are failing under the attack of phylloxera,

and on their roots we discovered the disease, when it could not be traced on the roots of the resistant stocks. The writer was not the only one to look for it, for there were three others besides the complainant, two of whom ought to be well acquainted with it, as they have lost their vineyards through it. Not that I would have been surprised if any were found, as it is well

Late Sherry, on Gloire de Montpellier Stock, in second year.
Mr. McLean's Vineyard, Smithfield.

known that resistant stocks are liable to contract the disease which they withstand, only I mention the fact because it seems to me a most logical reproof.

It is a sorry affair that alleged grievances of this kind should be ventilated before diligently inquired into by a person with a knowledge of the subject. It is a sorry business, because inaccurate statements of the sort foment panic

in a matter of life and death for one of the most congenial staple industries of this State. The Cassandra-like prophecies which have been lightly uttered lately sound to the ear of most growers as prophetic warnings, causing uneasiness among those who are unable to sift the conflicting opinions. The value of a statement can only be gauged by the knowledge of the man that commits himself to it, but the growers are often not acquainted with the persons whose learning is to advertise sententious criticism on almost every subject of human knowledge. Naturally the hapless vigneron is apt to listen to both sides, thinking it prudence and one of the canons of wisdom, with the result that, unable to judge on a question which is both scientific and technical, he becomes all the time more perplexed, and, like Pontius Pilate, goes on asking: "*Quid est veritas*" (what is the truth)? The while his once luxuriant vines are reduced by phylloxera to so many stumps, when, instead of wavering, he should put his heart and soul in the work.

Every year as the planting season approaches there is a revival of the agitation against these stocks; misleading statements are uttered, often by

Mr. McLean's Reconstructed Vineyard, on Resistant Stock.

people who do not possess a single vine. The writer feels it incumbent to put vine-growers on their guard. The futility of replying to utterances of irresponsible persons will leave their statements unanswered by us, though we are ever ready to make inquiry in any case submitted to us by vine-growers.

The weathercock attitude taken by a few people towards the phylloxera policy of the Department during its different stages is recent history Once opponents to the phylloxera-resistant stocks, now praising them, and even finding that the Department does not do enough in that direction—knowing no limits, they propagate rumours that the Department fails to supply phylloxera-resistant stocks when a large number of them is available for distribution. Lately half-a-dozen vine-growers of the county of Cumberland came to the writer's office in a state of suppressed anxiety to know whether there was any truth in certain statements that had been divulged; and many more will, no doubt, take the rumours as representing the true state of affairs, and will not send their application for resistant stocks.

Grafted on Riparia Gloire de Montpellier.

	1904 Crop per Acre.	1905 Crop per Acre.	Acidity per thousand.	Sugar, by Fehling's liquor, per cent.	Guyot's Saccharometer.	Keen's Saccharometer.	Sugar by Salleron's Densimeter.	Temperature. (Fahr.)	Polarimetric rotation.	Glucose.	Levulose.
	lb.	lb.						°	° ′		
1. Aleatico	5,700	5,989	7·9	23·57	24·5	...	25·8	76	10 36	11·24	12·33
Witness	5,907	5,799	7·2	25·32	26·25	25·5	27·7	76	10 58	12·06	13·26
2. Cabernet	5,155	3,807	6·6	25·51	26·25	26·	27·5	74	10 48	12·45	13·06
Witness	2,880	4,641	5·6	27·20	27·75	27 25	29·6	74	11 4	13·42	13·78
3. Lambrusquat	6,742	7,935	5·6	21·15	22·25	..	21·	77	9 18	10·12	11·03
Witness	4,992	8,178	5·7	22·20	23·50	..	24·6	77	9 28	10·72	11·52
5. Mammolo	12,888	4,296	5·2	26·16	27·50	26·5	28·8	77	9 34	13·18	12·98
Witness .. .	10,544	7,187	4·7	25·50	26·75	26·	28·3	77	10 2	12·60	12·90
7. Muscat de Frontignac	1,074	6,354	6·7	26·	27·	...	28 6	76	9 28	13·02	13·
Witness	1,718	5,280	6·2	26·16	25·25	..	26·5	76	10 26	12·82	13·34
8. Verdot... . .	7,697	10,068	5·4	23·76	24·75	24·	24·5	67	9 44	11·80	11·96
Witness	7,194	9,958	7·6	19·89	21·	20·	25·5	67	8 32	9·82	10·07
9. Syrah	1,611	1,790	6·8	30·26	31·50	30·	..	77	......	...	...
Witness	3,298	4,430	5·9	27·	29·	27·5	30·7	77	9 32	13 72	13·28
10. Gordo Blanco	5,370	...	5·5	24·12	25·	24·50	26 2	76	9 24	12·	12·12
Witness	9,397	...	6·1	21·84	22·25	21 75	23·3	76	8 46	10·76	11·08
11. Verdelho	10,126	3,960	6·1	30·27	29·75	29·5	..	80	11 6	14·93	15·34
Witness	3,803	5,178	6·7	26·27	27·5	27·	29 5	80	9 32	12·74	13·53
12. Pedro Ximenes ..	2,953	7,876	6·4	23·37	24·75	.	25·9	77	9 8	11·69	11·68
Witness	2,864	5,414	7·3	24·51	25·5	..	26·7	77	9 4	12·32	12·19
13. Pinot Blanc ...	2,028	5,370	6·8	28·66	29·5	28·	...	72	12 20	13·90	14·76
Witness	4,393	4,794	5·7	23·75	25·25	.	26·3	72	11 16	11·30	12·45
14. Shepherd's Riesling ...	4,564	9,487	8·2	23·93	23·5	..	26·3	84	9 32	11·60	12·33
Witness ...	5,561	5,862	8·7	27·70	27·	...	31·1	84	10 34	13·54	14·16
15. Riesling	895	3,759	7·4	21·75	21·5	..	22·4	77	8 34	10·76	10·99
Witness	1,074	2,148	7·3	19·25	19·5	..	20·3	77	8 34	9·18	10·07
16. White Shiraz	5,459	9,934	6·9	23·84	24·75	.	25·6	77	9 42	11·67	12·17
Witness .. .	4,967	8,368	6·7	21 97	23·	...	23·8	77	9 2	10·72	11·25
17. Sultana	895	...	4·8	30·15	31 25	29·	...	59	14 26	14·61	15·54
Witness	1,986	...	5·	28·69	29·50	28·25	..	59	13 30	13·98	14·71
18. Thompson's Seedless...	3,356	...	6·1	25·71	26·25	25·25	26·	59	11 38	12·58	13·13
Witness	8,715	...	4·9	24·95	25·75	25·	25·2	59	11 10	12·32	12·63

Grafted on Riparia x Rupestris, 3,306.

	1904 Crop per Acre.	1905 Crop per Acre.	Acidity per thousand.	Sugar by Fehling's liquor, per cent.	Guyot's Saccharometer.	Keen's Saccharometer.	Sugar by Salleron's Densimeter.	Temperature (Fahr.)	Polarimetric rotation.	Glucose.	Levulose.
	lb.	lb.						°	° ′		
1. Aleatico	5,477	7,057	...	...	...	...	...	...	......	...	...
Witness	268	...	...	...	...	...	..	.	.....	...	...
2. Cabernet .. .	4,385	5,847	4·4	28·81	29·	28·	...	74	11 38	14·22	14·59
Witness	1,432	6,290	4·6	26·06	26·	25·5	27·6	74	10 48	12·79	13·27
3. Lambrusquat . .	6,981	12,768	6·1	20·45	21·25	...	22·4	77	9 8	9·74	10·71
Witness	4,756	6,883	6·1	20·41	20·25	...	21·6	77	9 16	9·65	10·76
5. Mammolo .. .	5,370	4,296	5·	25·06	28·25	27·	30·2	77	10 2	12·45	12·64
Witness	12,458	5,370	4·9	25·14	27·	26·	27·8	77	9 58	12·40	12·64
7. Muscat de Frontignac	4,296	10,049	7·5	22·78	23·	...	24·4	78	9 58	11·62	11·62
Witness	2,685	4,296	6·8	23·45	23·	..	24·7	78	10 56	11·10	12·35
8. Verdot ..	4,337	12,936	6·3	22·09	22·5	..	23·4	74	8 56	10·99	11·10
Witness	5,585	11,008	6·2	20·18	20·	...	20·7	74	8 26	9·95	10·23
9. Syrah . .	2,362	7,518	6·9	27·80	29·	28·	30·8	77	10 32	13·90	13·90
Witness ..	22,017	..	5·5	26·43	28·	27·	29·4	77	10 8	13·21	13·22
10. Gordo Blanco .	5,071	...	4·3	23·89	24·25	24·	25·7	76	9 30	11·82	12·07
Witness	3,965	...	4·4	23·40	24·	23·50	25·2	76	9 38	11·46	11·94
11. Verdelho	8,592	10,847	7·	28·54	28·5	28·	31·1	78	10 60	14·18	14·36
Witness .	2,899	5,614	7·1	29·12	29·	28·	31·1	78	...	...	...
12. Pedro Ximenes	1,253	8,771	5·6	25·94	26·25	25·5	27·5	77	10 6	12·07	13·87
Witness .. .	9,129	8,592	7·1	23·57	24·5	..	25·1	77	9 40	11·50	12·07
13. Pinot Blanc ...	3,818	5,262	5·8	27·20	28·	27·	28·9	72	12 38	12·94	14·26
Witness	2,886	3,818	5·	26·85	27·50	26·5	28·4	72	12 58	12·60	14·25
14. Shepherd's Riesling	8,592	3,962	6·4	22·26	22·75	...	24·3	84	9 10	10·67	11·59
Witness . ..	5,504	5,948	5·7	26·16	26·50	..	28·1	84	8 48	13·24	12·92
15. Riesling	..	..	6·8	21·28	21·25	..	22·4	77	8 46	10·58	10·70
Witness . ..	...	...	7·3	23·3	23·	...	24·6	77	9 10	11·52	11·78
16. White Shiraz ..	8,256	13,357	6·6	23·03	24·	...	25·1	77	8 52	11·45	11·58
Witness	2,983	11,545	6·8	19·80	20·5	...	21·4	77	7 58	9·72	10·08
17. Sultana	2,148	...	5·7	27·80	28·75	27·75	...	59	12 46	13·65	14·15
Witness	4,027	..	6·5	23·54	24·25	23·50	23·4	59	11 6	11·45	12·09
18. Thompson's Seedless..	6,041	..	5·1	27·14	28·5	27·	28·7	59	12 14	13·49	13·65
Witness	8,103	..	5·4	24·31	24·75	25·	24·4	59	.. ..		.

Grafted on Riparia x Rupestris 3,309.

	1904 Crop per Acre.	1905 Crop per Acre.	Acidity per thousand.	Sugar by Fehling's liquor, per cent.	Guyot's Saccharometer.	Keen's Saccharometer.	Sugar by Salleron's Densimeter.	Temperature. (Fahr.)	Polarimetric rotation.	Glucose.	Levulose.
	lb.	lb.						°	° ′		
1. Aleatico	3,177	3,368	7·1	25·31	25·75	25·	27·8	77	10 50	12·03	13·28
Witness	...	...	6·35	28·16	29·75	28·5	...	77	11 32	13·78	14·38
2. Cabernet	2,932	4,393	6·1	26·62	27·50	26·50	29·6	74	10 58	13·08	13·54
Witness	1,432	2,538	5·8	27·71	28·50	27·25	29·9	74	11 58	13·43	14·28
3. Lambrusquat .	6,981	5,807	6·9	21·30	21·75	...	23·	77	9 14	10·23	11·07
Witness . .	3,020	6,942	5·2	21·05	21·50	..	22·4	77	9 24	10·	11·05
5. Mammolo .. .	7,322	4,540	5·3	25·58	27·	26·	28·8	77	10 14	12·19	13·39
Witness	1,611	4,967	4·85	24·70	25·25	24·50	27·	77	9 36	12·24	12·46
7. Muscat de Frontignac	2,470	3,356	6·3	26·28	26·	25·	29·7	76	10 36	12·94	13·34
Witness	1,074	...	6·7	27·65	27·	25·5	28·9	78	11 10	13·58	14·07
8. Verdot	3,651	6,688	6·5	22·05	22·25	...	23·4	74	9 6	10·85	11·20
Witness . .	5,370	5,235	6·4	19·69	20·75	...	21·8	74	8 36	9·50	10·19
9. Syrah . ..	5,907	3,973	7·3	28·80	30·5	30·	..	...	.. ...	...	..
Witness	690	3,383	5·6	28·47	30·	29·	...	...	..	..	
10. Gordo Blanco	1,476	...	4·7	24·14	24·75	24·	26·	76	10 26	11·66	12·48
Witness .	4,871	...	4·4	21·02	21·75	21·	22·8	76	9 14	10·10	10·92
11. Verdelho ...	4,491	4,430	7·2	26·50	27·25	27·	30·3	80	9 48	13·08	13·42
Witness	4,833	4,534	7·6	28·73	29·75	29·	..	80	9 30	14·52	14·21
12. Pedro Ximenes ..	...	8,592	5·1	24·70	26·5	..	27·5	77	9 42	12·21	12·49
Witness . ..	4,922	6,645	6·2	23·84	24·	..	25·1	77	8 58	11·92	11·92
13. Pinot Blanc	1,342	...	6·5	29·25	30·5	30·	..	73	12 52	14·10	15·15
Witness	1,235	3,759	5·9	28·42	29·75	29·25	...	73	13 32	13·35	15·07
14. Shepherd's Riesling..	2,685	5,504	5·6	29·70	30·25	29·	...	87	10 48	14·80	14·90
Witness ...	2,148	7,709	5·9	24·03	24·75	...	27·8	87	8 34	11·93	12·10
15. Riesling	...	2,148	7·1	25·62	25·25	25·	27·3	79	10 8	12·61	13·01
Witness .. .	2,148	2,685	7·1	24·80	24·75	...	26·5	79	9 44	12·22	12·58
16. White Shiraz ..	3,580	7,398	6·4	25·30	25·75	25·	27·5	79	10 2	12·41	12·89
Witness	4,149	10,391	5·9	18·16	19·	...	20·3	79	7 26	8·82	9·34
17. Sultana	..	...	...	...	...	...	...	...	......	...	...
Witness	1,790	...	...	...	...	. .	...	...	.....	...	...
18. Thompson's Seedless	2,819	...	3·3	30·76	32·25	31·	...	59	14 14	15·10	15·66
Witness	8,250	...	3·4	30·64	31.50	30·	...	59	14 12	15·04	15·60

Grafted on Riparia x Rupestris 101¹⁴.

	1904 Crop per Acre.	1905 Crop per Acre.	Acidity per thousand.	Sugar by Fehling's liquor, per cent.	Guyot's Saccharometer.	Keen's Saccharometer.	Sugar by Salleron's Densimeter.	Temperature. (Fahr.)	Polarimetric rotation.	Glucose.	Levulose.
	lb.	lb.						°	° ′		
1. Aleatico	2,685	4,355	6·15	24·00	25·75	25·2	27·	77	10 10	12·18	12·72
Witness	2,071	4,784	6·65	27·00	27·50	26·25	28·8	77	11 22	13·14	13·86
2. Cabernet	3,651	5,683	4·3	26·36	26·50	26·	28·6	74	10 50	13·10	13·46
Witness	1,772	9,788	5·2	26·30	25·5	25·	27·	74	10 54	12·90	13·40
3. Lambrusquat... .	8,293	12,172	5·4	22·53	23·	...	24·	77	9 52	10·79	11·74
Witness	5,181	9,170	6·	22·10	21·75	...	23·	77	9 26	10·67	11·43
5. Mammolo	8,055	4,631	4·8	31·13	31·75	30 5	...	77	12 38	14·55	16·58
Witness	9,827	7,931	5·3	23·57	23·50	...	24·6	77	9 58	11·40	12·17
7. Muscat de Frontignac	1,342	4,296	6·2	28·2	29·5	...	...	76	11 2	14·34	14·38
Witness	1,611	5,523	6·8	22·95	23·5	...	24 9	78	8 42	11·41	11·54
8. Verdot ...	2,953	10,620	6·8	20·04	20·	...	20·4	74	8 32	9·78	10·26
Witness	4,881	8,250	6·7	20 44	21·	21·	20·2	67	8 56	10·04	10·40
9. Syrah .. .	8,055	4,967	6·4	33·20	34·5	33·	...	77	11 32	16·86	16·34
Witness .	6,014	5,907	5·3	27·88	28·5	27·	30·4	77	9 16	14·60	13·28
10. Gordo Blanco ..	2,148	...	7·5	22·40	22·75	22·25	23·8	76	8 52	11·09	11·31
Witness	0,039	.	5·	21·05	21·70	21·	21·8	76	8 58	10·21	10·84
11. Verdelho .	6,904	7,070	6·2	28·35	28·5	28·	...	80	9 54	14·19	14·16
Witness . . .	5,600	6,242	6 9	29·97	29·25	28·25	...	80	11 6	14·70	15·18
12. Pedro Ximenes .	6,981	5,235	6·9	21 97	22·5	...	23·5	77	8 30	10·96	11·01
Witness ...	6,597	8,055	6·6	22·53	23 75	...	24·6	77	8 38	11·21	11·32
13. Pinot Blanc	5,370	4,117	5·3	29·90	31·50	30·5	...	72	11 38	14·94	14·96
Witness . .	3,222	3,835	6·	28·70	29 5	29·	...	72	12 38	13·76	14·74
14. Shepherd's Riesling .	7,070	9,725	6·8	28 85	29·75	...	...	87	11 26	13·94	14·91
Witness	5,783	8,285	7·9	25·2	25·	...	28·4	87	9 20	12·40	12·80
15. Riesling	644	5,370	6·7	24·20	24·25	. .	25·4	77	9 40	11·86	12·34
Witness	1,342	3,114	7·2	23·77	24·	...	25·4	77	9 78	11·52	12·22
16. White Shiraz ...	12,351	13,067	6·3	25·31	26·	25·	27·	77	10 20	12·31	13·
Witness	6,785	9,252	7 4	20·70	20·	...	20·8	77	8 22	10·	10·50
17. Sultana	...	...	5·2	27·17	27·75	27·	27·9	59	13 8	13·10	14·07
Witness	4,296	...	5·2	30·80	30·75	30·	...	79	14 14	15·08	15·72
18. Thompson's Seedless	5,549	...	4·	30·92	31·75	30·25	...	59	13 42	15·38	15·54
Witness	9,046	...	4·5	30·42	32·	30·5	...	79	12 4	15·62	14·80

Grafted on Rupestris du Lot.

	1904 Crop per Acre.	1905 Crop per Acre.	Acidity per thousand.	Sugar by Fehling's liquor, per cent.	Guyot's Saccharometer.	Keen's Saccharometer.	Sugar by Salleron's Densimeter.	Temperature. (Fahr.)	Polarimetric rotation.	Glucose.	Levulose.
	lb.	lb.						°	° ′		
1. Aleatico	3,087	3,375	...	...	...	...	...	...	......	...	...
Witness	...	..	...	...	...	...	...	...	......	...	...
2. Cabernet	2,565	3,938	6·9	26·56	27·25	26·25	28·4	74	11 40	12·81	13·75
Witness	2,761	5,387	4·6	25·10	25·	...	26·	74	10 10	12·40	12·70
3. Lambrusquat ...	3,938	5,907	4·4	24·32	24·75	...	25·9	77	10 32	11·68	12·64
Witness	2,440	9,666	5·6	20·	20·25	...	21·1	77	9 6	9·45	10·55
5. Mammolo	4,756	2,148	4·6	24·95	27·	26·	28·6	77	11 18	11·82	13·07
Witness	984	10,364	4·8	21·44	22·25	...	23·5	77	8 16	10·65	10·79
7. Muscat de Frontignac	2,416	3,275	6·7	28·52	28·25	...	31·	81	11 04	13·92	14·60
Witness	716	6,609	6·8	21·20	21·25	...	22·5	81	8 24	10·40	10·8
8. Verdot	8,055	4,149	5·7	25·51	25·5	25·	26·6	74	10 26	12·56	12·95
Witness	5,056	9,666	6·7	18·43	18·25	...	19·3	74	7 26	9·09	9·32
9. Syrah	1,342	5,370	3·8	27·43	28·75	27·5	30·7	77	10 44	13·40	14·03
Witness	3,460	8,353	4·6	26·42	27·	26·	28·8	77	9 14	13·46	12·96
10. Gordo Blanco ..	2,489	...	5·2	26·88	28·25	27·	30·	76	9 18	13·68	13·20
Witness	6,297	...	4·3	25 05	25·50	24·75	27·	76	8 46	12·80	12·25
11. Verdelho	805	5,370	6·1	30·27	30·5	30·	...	80	10 48	15·20	15·07
Witness	3,281	5,799	6·7	30·27	30·5	30·	...	80	10 20	15·08	15·12
12. Pedro Ximenes ..	3,222	5,728	4·7	25·50	26·5	26·	28·	77	9 38	12·74	12·76
Witness	2,454	10,740	7·8	19·84	20·25	...	20·8	78	7 34	9·86	9·98
13. Pinot Blanc	1,396	2,685	5·2	30·62	31·25	30·5	...	81	12 50	14·62	16·
Witness	1,133	4,671	5·5	24·90	26·5	25·5	28·6	81	10 64	11·77	13·13
14. Shepherd's Riesling ..	4,756	5,370	5·2	29·83	29·25	28·	...	87	11 0	14·79	15·04
Witness	3,102	5,452	7·6	27·08	26·25	26·	29·7	87	10 48	13·06	14·02
15. Riesling	..	...	6·6	25·10	25·	...	26·4	76	10 40	12·13	12·87
Witness	...	...	7·9	21·07	22·5	...	23·2	76	9 26	10·16	10·91
16. White Shiraz ..	1,521	5,907	6·7	24·50	26·25	25·5	27·6	80	10 6	11·84	12·74
Witness	5,131	10,509	7·3	21·40	23·	...	25·	80	8 58	10·29	11·11
17. Sultana	1,342	...	5·3	28·16	28·50	27·25	28·4	59	12 54	13·82	14·34
Witness	1,342	...	5·	28·16	29·	28·	...	59	12 54	13·82	14·34
18. Thompson's Seedless...	6,444	...	4·8	29·42	29·75	29·	..	59	14 14	14·18	15·24
Witness	4,206	...	4·7	29·02	31·75	30·5	...	59	12 52	14·40	14·62

Grafted on Cabernet x Rupestris, No. 33.

	Acidity per thousand.	Sugar by Fehling's liquor, per cent.	Guyot's Saccharometer.	Keen's Saccharometer.	Sugar by Salleron's Densimeter.	Temperature. (Fahr.)	Polarimetric rotation.	Glucose.	Levulose.
						°	° ′		
2. Cabernet	4·7	28·60	29·50	28·25	30·3	72	12 14	13·98	14·62
Witness	6·	27·70	28·25	27·50	30·	72	10 10	13·76	13·94
4. Malbeck	5·1	28·56	29·75	28·25	...	72	.....	...	...
Witness	5·9	27·18	27·25	26·50	29·1	72	11 0	13·48	13·70
7. Muscat de Frontignac	5·6	29·36	32·	30·5	...	72	11 54	14·56	14·80
Witness	7·2	30·62	31·	30·	...	72	13 28	14·82	15·80
9. Syrah	...	...	...	...	...	...	......	...	...
Witness	...	...	...	...	...	...	......	...	...
11. Verdelho	8·1	25·32	25·75	25·50	26·3	65	10 56	12·52	12·80
Witness	7·1	28·38	29·25	28·25	...	65	12 12	14·06	14·32
12. Pedro Ximenes ...	4·6	24·33	24·75	24·	26·2	76	9 34	12·06	12·27
Witness	4·7	23·85	24·50	24·	25·7	76	9 14	11·88	11·97
13. Pinot Blanc	...	...	...	...	...	...	.. .	...	...
Witness	...	..	...	...	...	...	. . ..	..	...
14. Shepherd's Riesling..	...	...	...	...	...	...	... ..	...	...
Witness	...	...	...	...	...	...	.. ...	..	...
15. Riesling	...	...	...	...	. .	...	......	...	...
Witness	...	...	...	...	...	...	.....	...	...

Grafted on Mourvèdre x Rupestris, No. 1,202.

	Acidity per thousand.	Sugar by Fehling's liquor, per cent.	Guyot's Saccharometer.	Keen's Saccharometer.	Sugar by Salleron's Densimeter.	Temperature. (Fahr.)	Polarimetric rotation.	Glucose.	Levulose.
						°	° ′		
2. Cabernet	7·6	26·20	27·	26·	27·6	72	10 30	13·04	13·16
Witness	5·8	26·80	27·	26·	28·4	72	11 0	13·24	13·56
4. Malbeck	5·4	27·35	27·	26·	28·1	72	11 8	13·55	13·80
Witness	5·8	26·94	26·25	25·50	27·6	72	11 6	13·30	13·64
7. Muscat de Frontignac	6·2	27·45	27·75	26·50	28·5	72	......	...	..
Witness	6·2	29·80	30·	28·5	...	72	12 54	14·60	15·30
9. Syrah	8·2	27·52	28·50	27·50	29·8	68	10 22	14·2	13·50
Witness	6·3	29·38	31·	29·50	..	68	10 16	15·12	14·26
11. Verdelho	7·7	29·38	30·25	29·25	...	65	12 46	14·50	14·88
Witness	6·4	30·19	30·75	30·	...	65	11 48	15·41	14·78
12. Pedro Ximenes ...	5·4	18·90	19·50	19·	20·4	76	8 10	9·18	9·72
Witness	5·9	21·97	22·75	22·50	23·8	76	.. ...	...	...
13. Pinot Blanc	7·5	22·50	23·25	22·75	24·8	77	9 14	11·00	11·50
Witness	6·2	26·21	27·25	26·50	29·4	77	10 24	12·90	13·31
14. Shepherd's Riesling..	4·3	25·59	26·	25·25	27·3	76	10 32	12·54	13·05
Witness	4 7	28·19	29·	28·	...	...	......	...	...
15. Riesling	...	...	...	...	...	...	......	...	...
Witness	...	..	...	...	...	...	.....	...	...

Grafted on Rupestris Metallica.

	Acidity per thousand.	Sugar by Fehling's liquor, per cent.	Guyot's Saccharometer.	Keen's Saccharometer.	Sugar by Salleron's Densimeter.	Temperature. (Fahr.)	Polarimetric rotation.	Glucose.	Levulose.
						°	° ′		
2. Cabernet	7·6	26·73	28·5	27·	28·9	65	11 10	13·31	13·42
Witness	6·8	27·80	29·25	28·	...	65	11 6	14·06	12·74
4. Malbeck	5·6	21·59	21·50	21·	22·3	72	9 42	10·53	11·06
Witness	4·8	28·42	28·	27·	29·5	72	11 52	13·98	14·44
7. Muscat de Frontignac	5·9	30·62	31·	30·	...	67	13 46	14·84	15·78
Witness	6·6	33·60	34·25	32·5	...	67	14 16	16·57	17·03
9. Syrah	7·1	31·72	33·50	31·50	...	67	... ..	...	...
Witness	6·3	32·13	34·25	32·25	...	67	......	...	...
11. Verdelho	7·7	25·67	26·25	25·25	26·3	68	10 54	12·76	12·91
Witness	6·5	28·68	30·	28·75	...	68	10 36	14·79	13·89
12. Pedro Ximenes ..	5·6	23·79	24·50	24·	25·1	68	9 22	11·90	11·89
Witness .. .	4·9	24·18	25·	24·	26·2	76	9 32	12·00	12·18
13. Pinot Blanc	...	...	...	...	...	...	......	...	...
Witness	...	...	..	...	...	...	.....	...	...
14. Shepherd's Riesling..	4·6	25·67	26·50	25·5	28·4	76	10 58	12·43	13·24
Witness .. .	4·1	28·32	29·50	28·50	.	76	11 36	13·95	14·37
15. Riesling	6·9	22·84	23·25	23·	24·4	76	9 38	11·12	11·72
Witness	6·2	24·08	24·75	24·	26	76	9 6	12·07	12·01

Grafted on Rupestris Martin.

	Acidity per thousand.	Sugar by Fehling's liquor, per cent.	Guyot's Saccharometer.	Keen's Saccharometer.	Sugar by Salleron's Densimeter.	Temperature (Fahr.)	Polarimetric rotation.	Glucose.	Levulose.
						°	° ′		
2. Cabernet	6·1	25·80	27·50	26	28·1	72	9 46	13·03	12·77
Witness	5·6	25·30	25·5	24·5	26·5	72	9 52	12·68	12·62
4. Malbeck	5·3	26·32	26·25	25·5	27·1	72	11 2	12·93	13·39
Witness	6 9	25·41	25·75	25 5	26·8	72	10 46	12·43	12·98
7. Muscat de Frontignac	5·5	35·86	36·25	34·	..	68	15 30	16·23	19·63
Witness	6·8	32·18	32·75	31·	..	68	13 34	15·92	16·26
9. Syrah	8·1	30·74	32·25	31·	..	68	11 30	15·68	15·66
Witness	7·3	29·64	31·	30·	...	68	11 54	14·85	14·79
11. Verdelho	7·1	24·96	25·75	25·	26·	65	10 48	12·30	12·66
Witness	7·3	25·63	27·	26·	27·1	65	10 10	12·92	12·71
12. Pedro Ximenes ...	4·5	25·61	26·75	26·	27·5	68	9 28	13·10	12·51
Witness	6·4	22·89	23·25	22·75	23·5	68	9 8	11·49	11·40
13. Pinot Blanc	7·7	26·64	27·50	26·50	29·6	77	... ..	..	...
Witness	6·7	25·39	27·	26·	28·8	77	9 58	12·56	12·83
14. Shepherd's Riesling..	5 9	27·48	29·	28·	30·8	...	......	...	...
Witness	4·3	27·05	28·25	27·25	...	...	......	...	...
15. Riesling	5·7	22·13	22·25	22·	23·6	76	9 46	10 61	11·52
Witness	6 6	22·34	22·75	22·5	24·4	76	9 46	10 74	11·60

The Thorough Tillage System for the Plains of Colorado.

(From *Bulletin* 103, The Agricultural Experiment Station of the Colorado Agricultural College.)

BY W. H. OLIN.

I. The Principles of Semi-arid Farming.

REGIONS having an annual rainfall of less than 20 and more than 8 inches are usually considered semi-arid. To successfully grow crops in such regions requires a careful study of soil and climatic conditions, with a selection of crops as nearly adapted to these conditions as possible. Even when all requirements are seemingly met, a failure is sometimes the only result. Experience, and experiments already conducted in many parts of our nation's semi-arid belt, demonstrate that the preparation of a soil reservoir of good depth several months before seeding, the thorough culture of this ground before and after seeding, the selection of suitable varieties of crops the seed of which is grown under dry farming conditions, are essentials which very largely determine success in farming lands in Colorado where irrigation cannot be practised.

The preparation of the soil reservoir and seed-bed calls for careful ploughing, harrowing, and sub-surface packing.

1. *Ploughing.*

Jethro Tull, nearly two centuries ago, said "Tillage is manure." "Roberts' Fertility" says that stirring and mixing the soil is the one fundamental labour of agriculture. The object of ploughing should be to pulverise the soil, making it possible to prepare a good seed bed for the reception of the various farm seeds. The depth to plough must depend upon the time of ploughing, the character of the soil, and the crop to be grown.

Shallow ploughing is preferred for shallow soils underlaid by an inferior subsoil lacking in plant food. Spring ploughing for early crops should not be as deep as fall ploughing for the same crops. Experiments have shown that deep ploughing of stiff or clayey adobe land in the spring turns up unworked or new soil in which most of the plant food is not available, on account of the mechanical condition of the ground. Crops on lands thus ploughed often make an unfavourable growth. It is nearly always desirable to plough sandy and sandy-loam soils deep, since the plant food contained in these soils is easily available and the deep ploughing brings more plant food to the surface for the tender young plant to feed upon, giving it a sturdy growth at the start.

All deep ploughing is best done in the summer or fall. This permits the weathering of the soil through the fall and winter, making its mechanical texture more desirable and the plant food available. Deep ploughing assists

water to percolate or pass through to lower depths; hence it increases the water-holding capacity of the soil, a most important element in semi-arid farming. The deeper the ploughing the greater the soil reservoir. Experiments conducted at the Cornell Experiment Station, New York, by Dr. Roberts show that an acre of average soil in good tilth will hold 20 to 25 per cent. of moisture and not be too moist for cultivation. It is estimated that an acre of soil 12 inches deep will weigh 1,800 tons if it contains 20 per cent. of moisture, 1,620 tons if it contains 8 per cent. of moisture—the amount upon which plants are able to grow and maintain themselves. Dr. Roberts says that an inch of rainfall brings to each acre $113\frac{7}{16}$ tons of water. If this could all be retained in average soil it would mean almost $7\frac{2}{3}$ per cent. moisture—nearly enough to maintain plant growth. Well-fined soil is capable of taking up 2 inches of rainfall in the first foot of soil and still be in good condition to cultivate. Suppose that this soil is deeply ploughed and contains 15 per cent. of moisture; an inch or a 2 inch rain would find the soil reservoir able to hold it. If this ground were shallow-ploughed, say 4 inches, an inch rain would saturate the reservoir, while a 2-inch rain would overflow the soil reservoir, causing a loss of water and severe washing away of the surface soil. Deep ploughing therefore increases the storage capacity of moisture in our soils from which the plant draws as it has need.

Good ploughing gives a clean cut furrow on side and bottom. It turns the inverted furrow slice upon edge in a moderately well pulverised condition with but few air spaces at the bottom edge of the furrow slice. A good coulter lessens draught and aids in making a clean-cut furrow. Discing the ground before ploughing is advantageous but increases the expense of preparing the seed-bed.

A seed-bed from 1 to 3 inches deep can be prepared without ploughing. The young plants may grow sturdily at first, but if the soil is not in a physical condition to store the moisture necessary to dissolve the plant food and render it available for the growing plant, lack of nourishment will bring it to an untimely end and the crop will prove a failure. Very successful crops are grown in this way, when the moisture is supplied by ditch or sub-irrigation, but it is always hazardous to attempt cropping without thorough tillage under semi-arid conditions.

A disc plough will often leave the soil in a good condition for the harrow, when the ground is too hard for a mould-board plough to do satisfactory work. The drier the ground the narrower should be the furrow, whether the plough be a mould-board or a disc plough.

2. *Harrowing the Ground.*

Harrowing is the process of stirring the soil by some form of a toothed or circle knife implement. Its purpose is the pulverising of the soil, reducing it to a finer tilth than the plough left it, filling the interstices left by the plough and thus levelling the soil. I believe that the spike-toothed harrow is the superior implement for pulverising after the plough. It should follow as near after the plough as possible so as to prevent loss of moisture by

evaporation from the newly-ploughed earth and the formation of clods. Each half-day's ploughing should be harrowed that same half day in which it is ploughed.

Ground that is harrowed first lengthwise with the ploughing will retain its moisture better, since it regularly and evenly fills the interstices or openings at the bottom edge of each furrow slice. Always first harrow lengthwise and later cross harrow if the ground is not in fine enough tilth for the seed. Ground that is inclined to be cloddy should be worked with the disc harrow instead of the spike tooth, double discing or half lapping lengthwise with the furrows. See that your disc is the proper size to do the most effective work in pulverising the soil. A 14 to 16 inch disc generally pulverises better than an 18 or 20 inch disc, and the draught is correspondingly greater. Experiments seem to indicate that the small diameter discs are better adapted for farming conditions on the Colorado plains than the larger diameter discs. Experiments conducted by experiment stations and by Mr. H. W. Campbell, of Lincoln, Nebraska, shows that discing grain ground after the harvester prevents loss of moisture on stubble ground through too rapid evaporation, and prepares the ground for the absorption of rain.

3. *Sub-surface Packer.*

This tool consists of a series of wedge-face wheels attached to a common axle. These wedge-faced discs are 18 inches in diameter and placed vertically on the shaft 6 inches apart. This machine is better than a smooth roller, for a roller firms the surface soil with little or no effect upon the under or sub-surface soil. The packer firms the soil in the lower portion of the furrow slice, restoring the capillarity where ploughing had arrested it This firmed under-surface soil is enabled to draw moisture from below and give good normal root development. In case a sub-surface packer is not obtainable, a corrugated roller can be used. It firms the ground but not to the depth which the sub-surface packer does. These packers should be followed by a smoothing harrow to produce an earth mulch which shall arrest capillarity and thereby check evaporation.

A spike-toothed harrow with lever attachments for regulating the angle of the teeth is a very satisfactory implement for this purpose.

4. *Summer Culture.*

Fallowing ground—leaving the land without a crop for one or more seasons—was a common practice with the ancients. Dr. Roberts, in his work on "Fertility of the Land," says this was a necessity for them. The imperfect tools then used made but a small proportion of the plant food in the soil available, and the demands of the crops grown soon outran the obtainable plant food. Then the only method for renewal was to let the soil "weather out" enough plant food, with the decayed vegetable matter to sustain another crop. Some centuries later the French found that "manœuvering" the land—causing the particles of earth to change place by tillage—made it more productive. Experiments now show that summer tillage in our semi-arid lands has an added value—it conserves the moisture

while it renders more plant food available. Good results have been obtained in Eastern Washington, Eastern Oregon, Utah, and many sections of Colorado from summer culture of the land every other season. It has been found that in this way sufficient moisture can be stored from the year's rainfall to mature a crop in many localities.

After the snows of winter have melted in the spring, plough the ground at least 7 to 8 inches deep. Level this down with the harrow and packer, following this process with a smoothing harrow, forming an earth mulch to check evaporation. This mulch should not be too fine as the winds of the plains will tend to rift the soil, or blow the earth mulch *entirely* away. If possible, stir the surface soil from 2 to 4 inches every ten to fifteen days throughout the summer. Allow no crust to form after summer showers, as this will increase the evaporation of the soil moisture. Keep the ground clean—free from weeds.

If fall grain is to be sown it is advisable to drill in the grain, as this insures getting it below the earth mulch, which is really a dry-earth blanket used all summer to hold the moisture in the soil below. Get the seed into this moist under-soil where it can have the moisture so essential for germination. It is advisable to seed fall grain not later than the last week in September in the lower altitudes and not later than the first week in September in the higher altitudes; better still, the third or last week in August.

Ground that has been well cultivated for several years will produce two crops in succession and can be given summer culture the third year. In this way it is possible to grow two crops in three years.

If a farmer expects to cultivate 80 acres he should divide it into two crop divisions—cropping 40 acres the first year and giving summer culture to the other 40 acres. This gives him a crop on one half his land each year while he is storing up moisture in the soil reservoir of the other half to make the next year's crop. Farmers in the southern part of Larimer County, Colorado, have been able to raise quite satisfactory wheat, barley, and forage crops by following this method of cropping.

Mr. Geo. D. Porter, living at Akron, Colorado, near the centre of the plains region, has used this method of cropping, for a small area, for several years. He reported last fall, when he seeded his winter wheat, a soil reservoir in which there was 5 feet of moisture. Last season gave us an unusual amount of rainfall, but this summer culture has been practised in some parts of California for more than forty years with satisfactory results. The writer knows one section of California where it seldom rains from April to September, yet here some of the finest fruit and grain is grown. This region in California has an ample supply of moisture in the rainy season—the winter months. This illustration is simply given to show the value of the earth mulch in holding the moisture which is already in the soil reservoir.

Mr. S. S. Peterman has a cherry orchard near Fort Collins that has never been irrigated. He depends upon rainfall for his moisture in a region that averages scarcely 15 inches per annum. As soon in the spring as possible he cultivates his orchard and continues to stir the ground until the fruit sets.

His trees bear fine flavoured cherries in a satisfactory quantity, while his orchard is the cleanest one in the neighbourhood. This orchard is eight years old, but has not yet weathered one of our "dry" years.

Summer culture keeps the ground in good tilth, keeps down weeds, renders the plant food easily available for the next year's crop, while it stores up the moisture so necessary to the plant in assimilating its food.

II. SELECTION OF SEED FOR SEMI-ARID CONDITIONS.

Climatic conditions are believed to have an influence on the development of certain temperaments and characteristics in the breeding of live stock, although the hereditary power of a well-bred horse, cow, or sheep to transmit its qualities to its descendants is the major influence and measures the value of a pedigree.

While plants, like live stock, certainly have strong hereditary power, yet it seems true that climate, soil, and cultural methods have an influence on the manner of growth of very many crops grown in our fields.

M. de Candolle, an eminent plant scientist, has succeeded in finding the wild forms of 193 of the 270 species of cultivated plants. Of the remaining seventy-seven, twenty-seven he names as possibly half-wild, and the rest he has so far failed to discover in the wild state.

Darwin in his investigation of domesticated plants came to the conclusion that in cases similar to this the cultivated plant either was so changed in its growing habit by its new environment that its wild prototype could not be recognised, or that its original parent ceased to exist.

Professor A. M. Ten Eyck, of Kansas, in an address on "Plant Adaptation," before the Corn Breeders' Association of that State last March, stated :—

From a single, comparatively valueless primitive wild form have originated in the course of time thousands of valuable varieties of plants, all differing from the original and some to such an extent that they cannot be recognised.

Professor W. M. Hays, in the Minnesota Experiment Station *Bulletin* No. 62, speaking of variations in individual wheat plants, says :—

Among the 400 plants of McKendry's Fife for example, plants were found which matured in 97 days, others requiring 127 days. Among Powers' Fife (wheat) plants, the range was from 98 to 172 days ; and among Haynes' Blue Stem plants the range was from 99 to 128 days.

The ten plants which appeared to the eye as the best yielding plants out of the 400 of each variety were harvested, and notes taken as to the height of plant, number of spikes, length of spikes, and yield of shelled grain. The following table shows the extremes of the variation in each case :—

VARIATION among best 10 out of 400 Wheat Plants.

Name of Variety.	Height of Stalks. inches.	Length of Spikes. inches.	No. of Spikes.	Yield in grams.
Haynes' Blue Stem ...	31 to 39	4 to 4½	19 to 31	15·4 to 19·4
Powers' Fife	27 to 33	3½ to 4	18 to 33	3 4 to 13·8
McKendry's Fife ...	30 to 33	3½ to 4	22 to 33	6·8 to 16·7

In breeding corn (maize), the writer has observed that individual plants in the same breed or type of corn vary widely in producing power, height of ears on the stalk, height of stalk, width and number of leaves, and period of maturity of corn. The Iowa Seed Company state their earliest maturing type of dent corn—Farmers' Reliance—was developed by selecting the lowest

ear on individual plants, these ears usually ripening first. At the Kansas station a pure-bred type of corn known as Reid's Yellow Dent, was planted in the season of 1903—an ear to a row. These ears were carefully selected for uniformity and trueness to the breed characteristics of that type of corn. The resulting harvest from these different rows showed almost as much difference in the character of plants in different rows as in different supposedly fixed types of yellow dent corn, while difference in yield between highest and lowest was nearly 400 per cent. The very best ears from the best yielding and most desirable mother ears were selected for the mother ears of 1904, and seeded an ear to a row. Marked differences in growing habit were noted, but difference in yield from lowest to highest was but a trifle more than 80 per cent—one-fifth what it was the preceding year.

Selection is the process by which new varieties are fixed. Artificial crossing may be used to induce variation, with a view to promote the development of new forms. but selection is always the final process by which new varieties are established and maintained.

Three principal factors largely determine the value of a variety of any cultivated crop, namely, yield, quality, and adaptation—and the last-named is really the deciding factor which determines whether a variety type may be successfully grown in any locality. In no two countries, perhaps in no two sections of the same country or State, are the plants subject to exactly the same conditions of soil and climate. One section may have a different soil, a little more dry weather, and the plants of this section vary to adapt themselves to these conditions. If the plant is removed from its native habitation and planted in a different part of the world or country, in a different soil, surrounded by different conditions to those to which it has been accustomed, it is placed at a disadvantage, it is exposed to a new environment to which it is not suited. Thus we can understand why a good variety of fruit or grain does not always give as good results in all places, and we should expect a variety of plants originating from the plants of a certain region to be best adapted for growing in that region, or such plants may be adapted for growing in any region having similar conditions of soil and climate.

We find a demonstration of this principle in the fact that wheat and other grains brought from the steppes of Russia and Turkey are well adapted for growing in the western plains region of the United States, which has a climate and soil very similar to that of the countries named. The Turkey Red wheat, for instance, has largely replaced all other varieties of winter wheat grown in the West, because of its greater hardiness and productiveness, and yet some of the varieties which it has succeeded had been grown in the West for many years and seemed to be fairly well adapted to western climatic and soil conditions. The superior hardness and adaptation which the Russian and Turkey varieties of grain appear to have in our western country may be largely credited to the centuries of training which these varieties have had in an environment almost identical with that of similar latitudes in the West, while the varieties which the Russian grains succeed, as a rule, have been those which have been gradually moved from the Eastern and Middle States farther west, and although many of these varieties have gradually become more or less hardy and fairly well adapted for growing in our western climate, yet, in the comparatively short period during which they have been grown under western conditions, apparently they have not become so hardy and well adapted to those conditions as the Russian and Turkey varieties.—(Prof. Ten Eyck's "Plant Adaptation.")

For more than ten years Mr. Robert Gauss, of Denver, has been growing a certain type of wheat, under drought conditions, with results that are in accord with statements made by Professor Ten Eyck. Each year Mr. Gauss has made his seed selections, looking toward the seeding of wheat for the plains, that has good drought-resisting qualities.

This past season the writer seeded some of this wheat in May, on the very driest seed-bed which he has ever used. It was sown broadcast, and seed covered with a spike-toothed harrow. The seeding was done on an experimental plot located on the C. F. and I. grounds, 5 miles south-west of Pueblo,

Colorado. This wheat matured when barley and oats, seeded at the same time, in the same seed-bed, perished for lack of moisture. Mr. Gauss tells me he can trace this wheat as a drought-resistant wheat for at least eighteen years; while his wheat has not been tested for milling qualities, his results would indicate the value of selecting seed grown under *semi-arid conditions, for semi-arid farming.* Persons coming from a lower altitude with a moist climate, often are completely prostrated on being transported to Leadville, Colorado's "Cloud City," nearly 2 miles above sea-level.

In a similar manner, but probably not to so marked a degree, altitude and climate affect our crops, and we should try to secure acclimated seed, or at least obtain seed from regions with similar climatic and soil conditions. Seed corn from the Mississippi River States cannot be expected to make a sturdy growth in Eastern Colorado; seed wheat from near tide water cannot be expected to make a quick rapid growth at an altitude of 8,000 to 10,000 feet.

Colorado farmers find grain of good quality grown and developed in the region of their farms gives best results, and Colorado grown seed should be so selected that it shall take precedence of all other seed on our home markets.

Mr. A. H. Danielson, Assistant Agronomist, a few years ago decided to test selection for hardiness in winter wheat. For this test he selected a number of varieties. The ones which showed the best quality grain and gave the best yields, he used as the basis for his work. The first year all were badly winter-killed. From the plants which lived through and matured grain, he obtained seed and so continued for four years. This year all of his plots showed a perfect stand, while other plots not thus treated showed from 20 to 30 per cent. winter-killed.

The value of good vital seed is shown in an experiment conducted by Professor R. A. Moore, of the Wisconsin Experiment Station, with oats. He selected from two pecks of seed oats sent to him by the United States Department of Agriculture, thirty-three especially fine, large, plump kernels, and planted them in a choice plot by themselves in 1899. From these plants he received sufficient seed to plant a good-sized bed. The next year he began sending out seed to members of the Wisconsin Experimental Union, asking that a record of harvest and sales be kept, so he could trace the progeny of his 33 oat kernels; last year (1904) he found the harvest of the oats with a pedigree tracing back to the 33 kernels of 1899, numbered 500,000 bushels. Hardness, quality, and productiveness are to be sought for in our field crops if we would farm profitably in any region. Because of the struggle for existence in our semi-arid fields, our farm seeds should be chosen with great care and with these three essentials always in mind.

Rate of Seeding.

Because of the limited amount of moisture in the soil a limited amount of seed should be used in seeding all crops grown on semi-arid lands which cannot be irrigated. If seeded too heavily, there is not sufficient moisture in the soil to mature all plants, and the entire crop in a very dry year is liable to "fire"—ripen prematurely. It is better to under seed rather

than to over seed. The rate of seeding depends so much upon the size of seed, mechanical condition of the seed-bed, method of seeding, and moisture conditions, that it is impossible to give the exact amount of seed which should be used in seeding the various field crops. The writer this past season carried on a co-operative experiment with a farmer, testing two varieties of drought-resistant wheats on sod. One was seeded nearly twice as heavy as the other one, yet the field having the lightest seeding had equally as good a stand as the field seeded the heavier, because there were nearly twice as many kernels in a bushel, and each kernel made a plant. Below is a suggestive table which may prove helpful to persons who are seeding crops for the first time on semi-arid lands. The amount of seed required is usually from one-half to two-thirds that which is used for the irrigated lands.

RATE OF SEEDING FOR NON-IRRIGATED LANDS.

Name.	lb. per Bushel.	lb. per Acre.
Grain Crops—		
Wheat	60	45 to 60
Barley	48	50 to 00
Oats	32	40 to 60
Rye	56	35 to 50
Emmer, or Speltz	40	45 to 60
Field Corn (in hills) (shelled)	56	4 to 6
Field Corn (in drills or lister rows)	—	5 to 7
Sweet Corn (in hills)	—	6 to 8
Sweet Corn (in drills)	—	10 to 15
Kafir Corn	56	4 to 5
Broom Corn	46 to 55	2 to 4
Field Peas	60	30 to 50
Field Beans	60	15 to 25
Proso	60	6 to 12
Millet	60	5 to 10
Buckwheat	50	20 to 30
Flax	56	20 to 30
Forage Crops—		
Sorghum or Cane	50	8 to 25 (varies with method of seeding.)
Alfalfa (Lucerne)	60	20 to 25
Meadow Fescue	24	15 to 25
Brome Grasses	14	15 to 25
Vetches	—	20 to 30
Root Crops—		
Sugar Beets	—	10 to 15
Mangel Wurzel	—	8 to 12
Carrots	—	3 to 5
Stock Turnips	—	$1\frac{1}{4}$ to 4 (manner of seeding.)

III. Crops for the Semi-arid Lands.

The amount of water required by growing crops is shown by experiments to vary with the soil, climatic conditions, and the nature of the crop grown. Crops having a large percentage of water in their composition will necessarily require more moisture to produce a healthy, vigorous growth than crops with a low percentage of moisture in their composition.

Experiments to determine the best grain, forage and root crops for drought-resistant power and productiveness are now being conducted at the experiment stations in the semi-arid States. Conclusive results have not yet been obtained, but the following crops are worthy of consideration for semi-

arid farming. All of these have been successfully grown in some portion of the semi-arid West, but probably none of these crops would do well in all regions of Colorado, where semi-arid farming is being practised.

Wheat. (A) Spring Wheat.

The best spring wheat variety for semi-arid conditions seems to be a durum wheat known as Kubanka durum—U.S. Cerealist, M. A. Carleton, introduced some fifteen variety types of durum from a part of Russia with soil and climatic conditions quite similar to Eastern Colorado. The type which seems best adapted to Colorado conditions is the Kubanka durum. This is a spring wheat in our latitude, and should be seeded as early in the spring as ground and weather conditions will permit.

The durum wheat having been grown for many generations in a semi-arid climate in Russia, withstands drought conditions better than our common spring wheats. It must be remembered, however, that no wheat can be matured without some moisture. Kubanka durum has good drought-resistant power, but one must not expect this wheat to mature a satisfactory crop without several inches of rainfall during the growing season. While durum wheat has been tested this past season in thirty counties in Colorado, experiments have not been conducted long enough to tell us the minimum amount of moisture required to produce a crop under our differing conditions of soil and climate.

This wheat has the heaviest and coarsest beards found on any wheat. The kernel is very hard, and most millers feel that this wheat requires special machinery for milling. For this reason but few local millers in the State are buying durum wheat. Mr. B. F. Hottel, of the Lindell Mills, Fort Collins, Colorado, ground 1,500 bushels of Kubanka durum last fall. He put up 5 lb. sample sacks of this flour, and the Agronomy Department assisted in placing these sacks in more than fifty families to be tested in both light bread and biscuits. The reports sent in from this test showed that light bread or biscuits made from Mr. Hottel's flour compared very favourably with the patent flour in common use, in texture, elasticity (lightness), flavour, and moisture. While the bread was possibly a shade darker it was not considered a serious objection. Comparative tests made later, by the Domestic Science Department, Mrs. A. M. Hawley and Mrs. Winnie E. Olin, confirmed the previous tests, showing the Hottel durum flour made a very satisfactory bread. This wheat is also used in making semolina a milled product, from which our very best French and Italian macaroni is made. A milling firm in Cincinnati, Ohio, is now making from 8,000 to 9,000 lb. of macaroni per day from western grown durum wheat. This wheat, when first introduced, was known as macaroni wheat, and it was believed that it could not be used for anything else. The milling and baking tests conducted in North and South Dakota, Minnesota, and Colorado, demonstrate that durum or macaroni wheat gives a desirable flour for bread or pastry. Professor J. H. Shepard, chemist, of the South Dakota Station, has found that the importation of wheat known as Kubanka No. 5,639, gives the best quality flour of all durum wheats.

This wheat should not be sown on the irrigated lands, as the use of too much water produces starchy kernels, causing the wheat to deteriorate in quality. It should not take the place of any bread wheat now being successfully grown in any region. It is recommended as a spring wheat on lands where other spring wheat does not yield a satisfactory crop, in a region where there is sufficient rainfall to mature a drought-resistant wheat, giving the farmer a semi-arid bread wheat. Like all new crops, a market must be developed for it.

This wheat has only been grown in our State a few years, and farmers are urged to study market conditions, and determine their acreage of this new crop by the market demands for this wheat.

(B) *Winter Wheat.*

The variety of wheat that has given the most satisfactory yields, and shown drought-resistant power, is Turkey Red. This wheat has been grown quite successfully in Kansas, Nebraska, and portions of Colorado for many seasons. It is the wheat which made Kansas the greatest winter wheat State in the Union, and is as good for the irrigated as for the semi-arid lands. The millers of Colorado prefer this to any other wheat for flour production. It has a ready and constant market at any mill in the State. Seed for semi-arid lands should be obtained from regions where this seed has been kept pure and grown "above ditch."

The sub-stations in Nebraska and Kansas, located in the western portions of these States, can aid our eastern Colorado farmers to obtain seed, and the Monticello sub-station farm in Utah will help our western Colorado farmers to obtain seed wheat, while the writer will also assist anyone desiring this wheat, to obtain as good seed as possible, grown under drought-resistant conditions.

Any winter wheat which has good milling quality, and shows drought-resisting power, adapted to the region where grown, can and should be developed by wise seed selection and careful culture treatment.

All semi-arid wheat should be harrowed, or run over with a weeder, to break up the crust which may form, and thus check too rapid evaporation. Wheat can thus be advantageously cultivated until it is knee high. Often, seeding rows 16 instead of 8 inches apart (stop up every other hole in the drill) is advantageous. Then one can use a beet cultivator or other small-toothed cultivator, and cultivate the crop, keeping the ground well stirred.

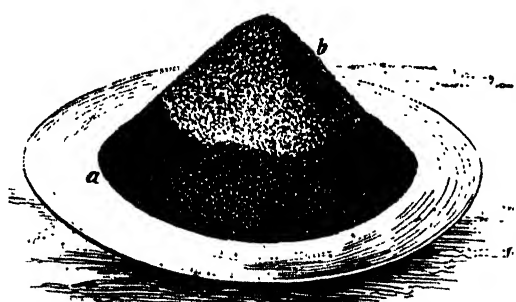
Cultivating grain in the semi-arid region lessens evaporation, and thereby hold more moisture for the growing crop.

[Several varieties of durum wheats, of which Kubanka is one, have been experimented with by the Department of Agriculture, under the control of the late Mr. William Farrer. Of these Mr. Farrer, in the March *Gazette*, page 283, says: This alone (speaking of "Cretan") of the macaroni wheats which have been examined in our Departmental Laboratory, produces flour of sufficiently good colour for bread-making purposes. . . . I, therefore, recommend our farmers, and especially those of our *interior*, to give a trial to this variety.—Ed. *A. G.*]

IV. Principle of Capillarity.

Water in the soil used in the plant economy is known as capillary water. The water found in the bottom of postholes dug in the wet ground, or standing on the surface of the ground, is called ground water or free water. This free water flows under the force of gravity, as does the water in our irrigation ditches. When the ground becomes thoroughly saturated, all the spaces between the grains of soil become filled with water. This cuts off all air from plants and they drown or suffocate.

Ground or free water is not, in that particular form, available to the plant. When it sinks into the soil, and, later, comes up in small quantities in the capillary tubes of the soil, it is the essential capillary water which aids in dissolving plant food in the soil so the root hairs can utilise said food. Plants get all the water they use through their roots. When the texture of the soil is just right and the amount of moisture ample, the soil grains and granules will be surrounded by this water as a thin sheet or film. This is continuous where the grains or granules are in contact, or nearly so, and seeks to extend in all directions. If a dish be filled with soil composed of grains, and this soil be rounded up into a cone, one can get some conception of this capillary action of the water in the soils of our fields.



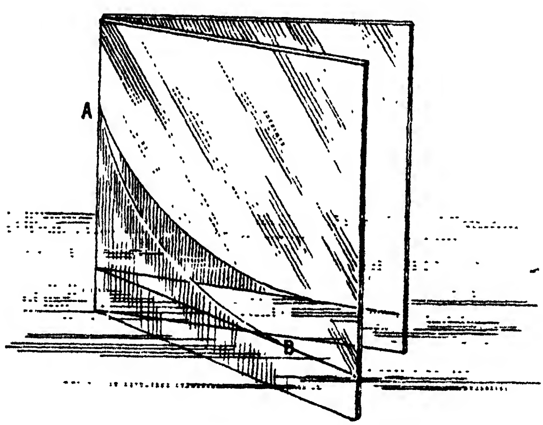
From "First Book of Farming." (*a*) Saturated soil-water drawn up by capillary action from bottom of basin. (*b*) Dry soil.

Pour water slowly into the dish, and it will be observed that soon this water is drawn quite a distance upward from the base of the cone, as shown in the diagram. Place two rectangular pieces of window glass in a basin of water (better coloured) so that two edges of the glass plates touch. It will be observed that where the edges are in contact with each other is where the water rises higher than anywhere else on the plates.

This action was also clearly shown by the diagram used by many text-books in physics. Place several glass tubes varying in size from a quarter of an inch in diameter to as small a tube as you can obtain, with one end of each tube in a basin of water. It will be noticed that the water on the sides of the tubes is above the height of the water in the basin, and the smaller the tube the higher will be the water on the sides of the tube.

The force which causes the water to rise in these tubes is called capillary force, from an old Latin word *capillum* (a hair), because it is most marked in hairlike tubes, the smaller the tube the higher the water will rise. The water which rises in the tube is called "capillary water."—Goodrich's "First Book of Farming."

It has been estimated by careful agriculturists that the film surface of a cubic foot of clay loam spread out would cover three-fourths of an acre. When these capillary tubes of the soil extend to the surface, the hot sun of our semi-arid lands pumps the water from them, which is seemingly wasted in the dry air of these regions. The earth mulch is the dry blanket which breaks capillary connection between the under surface soil tubes and the hot outer surface, checking this seriously rapid evaporation. Of course, the finer the mulch the more perfect its action. Were it not for the winds on our plains we could make a dust mulch, and thus get the most perfect earth mulch for checking evaporation of moisture from the soil. The danger from wind blowing soil and seed from the field is too great, and farmers are cautioned not to make the earth mulch too fine. Leave the soil as loose as possible on top, so as to prevent this capillary action reaching to the surface, but do not make it of dust-like fineness.



AB Water line between glass plates.

The blanket-like action of this earth-mulch, and the difficulty the water has in getting through it, is well illustrated by loaf sugar and granulated sugar. Place one of these hard squares of loaf sugar in a teaspoon, and lower it so it is partly submerged in a cup of tea. How soon it is saturated. Place the same amount of granulated sugar in the teaspoon, and lower it as before in the tea, and observe how much longer it takes to saturate the finely-ground sugar than it did the loaf sugar. The finer flour sugar used by confectioners takes still longer for water to saturate it. A thoroughly fine, dry, dust blanket requires more moisture to wet through it, to the soil you want to reach with moisture, since the dust is so much finer, and has, therefore, a greater film surface than the under soil. On the other hand, when moisture seeks to come up, it has the same difficulty to get to the surface of the dust blanket, and be lost in the hot, dry air above, which it experiences in getting down.

For this reason, our earth mulch should be kept as fine as the action of prevailing winds will permit.

Remember, capillary force will carry down as well as up, and we can deepen the root-growing power of our farm crops by deep ploughing and summer culture, which stores and conserves soil moisture.

Artesian Irrigation.

W. R. FRY,
Manager, Moree Experimental Farm.

ALTHOUGH many articles on irrigation have from time to time appeared in the *Gazette*, it can surely never be a *dry* subject, and in view of the varied opinions on the utility of our artesian waters for this purpose, some information on the subject may be of interest.

At the present time when, owing to the timely rains, the growth of grass and herbage is most luxuriant throughout the district, the necessity for irrigation may not be so apparent to the casual observer, but the demand for local grass lands by visiting pastoralists, proves that the rainfall in adjoining districts has not been so plentiful. At the beginning of the year feed was becoming very scarce in the immediate vicinity of Moree, while several train-loads of starving stock passed through on their way to the greener pastures of the highlands. During the drought of 1902 large quantities of fodder was sold from the Moree Irrigation Farm, and several mobs of starving stock were fed there prior to trucking, yet, on

Irrigated Sorghum and Aerator at Moree Irrigation Farm.

the opposite side of the road, special train loads of fodder were being transferred to teams for the other starving stock in the district. Several

stock-owners expended over £1 per head to keep their stud ewes alive, the cost of fodder being £17 to £20 per ton, while with the use of bore water, green fodder can be produced on the field for 2s. per ton. Now, as these droughts will come again, undoubtedly the best time to prepare for irrigation is during the occasional good seasons, when the land is easily worked, and horse-feed is plentiful. It has been frequently remarked that "our black-soil plains are wonderfully fertile *if they only get the rain.*" Unfortunately, however, they do not always get the rain when most required, and during these dry periods, when the surface is cracked and bare, their great fertility is so much capital lying idle. It must be remembered in all agricultural or pastoral pursuits in dry districts, that rain is always a remote probability, whilst systematic irrigation is an absolute certainty. Therefore, if these districts are to be ever developed to their greatest capacity, irrigation is an absolute necessity, and in the absence of permanent surface streams, we must depend on the subterranean waters. It is not probable that the products of artesian water will ever seriously compete in the Metropolitan market with that from closer and more favoured districts. There is no doubt that the water can be profitably utilised on pastoral properties to moderate the effects of droughts, and in back country towns to supply fresh fruit, vegetables, and dairy produce.

Advantages and Disadvantages of Bore-water.

The owner of an artesian well possesses certain advantages over other means of irrigation supplies, as after the initial cost he is saved the continual annual expense of pumping, and he has no trouble with riparian rights from his neighbours on the same stream. In spite of these advantages, the practice has not been so generally adopted as might be expected. Few settlers are fortunate enough to possess a private bore, and, in most instances, where the Government bores are vested in trusts, only the member at the end of the channel is able to irrigate, as his less fortunate neighbours between him and the bore-head have generally no right to the water other than for stock purposes. But, undoubtedly, the chief reason why the water is not more extensively used, is because of the much-advertised and in many cases misleading statement, that "the bore-water spoils the land."

Effect on Soil.

While it may be admitted that in some few cases the waters are too saline, and do eventually spoil the soil, in the great majority of cases satisfactory results can be obtained if the water is properly applied. Any water, whether from rain or river, if indiscriminately flooded over clay soils, without underground drainage, will, by making them sour and water-logged, eventually spoil the land. The writer has seen a splendid orange orchard, grown on clay soil, killed right out by flooding with fresh water pumped from the Hawkesbury River.

Wheat Crop, Moree Irrigation Farm.

Starving Stock being fed on green fodder grown on the Moree Irrigation Farm.

The water from the Moree Bore (which contains 44½ grains of solid matter per gallon) has now been used for irrigation purposes for the past seven years, and no injurious effect is yet apparent, whilst analysis of the soil shows no perceptible increase of alkali. At the Native Dog and Pera Bores the land has been irrigated for a longer period, and when we have evidence of the successful use of bore-water in Algeria and America for over thirty years, we should, at least, expect similar results in this State.

Analysis of Bore Water.

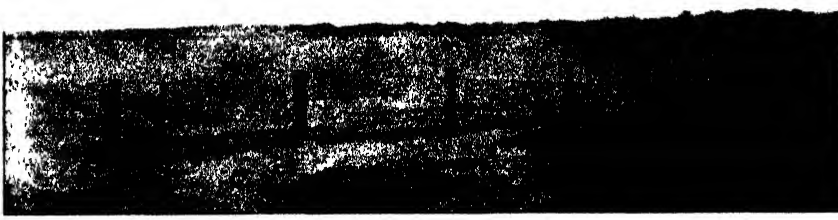
It is now generally considered that when the bore-water contains more than 50 grains of saline matter per gallon, that it is unsafe for continual irrigation, although, in the Hawaiian Islands, it is reported that sugar-cane is successfully grown with artesian water containing up to 60 grains per gallon. A most essential thing, therefore, for the settler before preparing for irrigating, is to send a sample of his bore-water to the Department for analysis, and if this is satisfactory, he can then proceed without doubt of satisfactory results. Should, however, the analysis show over this proportion, special care in the application is necessary, but the Departmental chemist will forward all necessary information on the subject.

View of Irrigated land.

Site of Bore Head.

Many artesian bores (like that at Moree) have been put down on an inconvenient or low portion of the estate, so that the water can only run westward, or into watercourses, and cannot be utilised for irrigation without the expense of fluming or a pumping plant. It is, therefore, necessary to see that the bore-head is on higher ground than that to be irrigated, and as most of the bores supply warm water, it is also very convenient, at any rate in winter, to have the hot water laid on to the homestead. The value of the mechanical power derivable from many bores has, also, not yet been realised,

but if the pastoralist is fortunate enough to have a high-pressure bore near the woolshed, he will be able to drive the sheep-shearing plant more economically than any other power. For the irrigation farmer, such a cheap power for separating, churning, chaff-cutting, threshing, &c., should be invaluable, and would not diminish the water supply. At the Mongulla Bore this power has been utilised by a Pelton wheel to drive a saw-bench and chaff-cutter, and the town of Thargomindah, in Queensland, is lighted with electric lamps from a similar source. This subject has been fully treated on by Mr. Gibbons Cox, in the *Gazette* (March, 1905), and reprints of his article will be forwarded on application to the Department.



View of Unirrigated Country, Moree.

Selection of Soil.

As the area available for irrigation in the north-western districts is, practically, unlimited, there is usually plenty of choice in the selection of soil. The most common soils within the artesian area are the light red soils and the black-soil plains. There are, also, the sandy pine ridges, frequently chosen as sites for homesteads, which, under irrigation, produce most excellent oranges; but the area of this soil is limited. The red soil, which grows good wheat, is of a sandy nature, and very suitable for irrigation, although apt to set very hard if flooded. The black-soil plains are chiefly made up of decomposed basalt, and, in places, of more recent river alluvial. Although frequently referred to as being of great depth, they are not always so, as a yellow-clay subsoil is found at a depth of about 3 feet at the Moree Farm. The black soil is the most fertile, but requires careful working under irrigation farming, as there is no underground drainage. If ploughed when wet, it turns up in great clods, which, if bound together by couch grass, will defy any implement to pulverise them. Owing to their stickiness when wet, ploughing operations are sometimes delayed during showery weather, but these periods are few and far between.

The coastal farmer, in choosing a cultivation plot, naturally first picks out the alluvial river flats, so the western irrigation farmer, working under more adverse conditions, should, if possible, select similar soils; but if this is not available, good results can be produced on the black-soil plains.

The soil at the Moree Experimental Farm is a typical black clay, so that the results obtained are applicable to thousands of acres in the artesian districts.

Bore Drains.

Having obtained a suitable supply of bore-water, the question of channels is of next importance. In this respect the clay soils possess considerable advantage, as when the earthen drains have once become puddled, they carry water splendidly, and the expense of fluming or cement channels, so necessary in sandy soils, is saved. Bore drains are generally opened with a plough and cleaned out with a delver. Various forms of delvers, or drain and channel making machines, are in use, but the most common is the "Western Wheeled Scraper, Aurora," Ill. U.S. This machine, which is drawn by ten or twelve horses, does very good work, but as it costs £85, and is not afterwards of much use on the place, it is more economical to have the channels made by a contractor possessing a suitable plant. Contour lines and levels for channels are best laid out by a surveyor, as appearances are deceptive, and

Bore drain showing growth of grass.

money has often been expended in channels which it was afterwards found ran up-hill. The fall of the ground in the artesian belt is invariably westwards, it being generally very difficult to get the bore-waters to run any distance towards the east. For cleaning-out channels several implements can be improvised, one of the most common being a large log to which is bolted two strong slabs, at an angle of 45 degrees, and meeting at the nose of the log. These slabs, which can be shod with iron, act as wings or mouldboards to throw the mud and rubbish out on to the bank. This implement can also be made so that the width of the angle can be altered for different sized channels, and is drawn by four horses, two on each side of the drain. Channels are more easily cleaned when a little water is running through than when dry; but the horses should not be coupled too close to the cleaner, otherwise the flood of water and mud is thrown on to the heels of the horses.

Aeration.

It is contended by many authorities that for successful results it is necessary to first cool and thoroughly aerate the water. No doubt some bore-waters would be improved by first being delivered into a receiving-tank; but so far as the Moree Farm is concerned, all the crops have been produced with warm water direct from the bore. A cooling reservoir is provided, however, and comparative experiments have been initiated, both with hot and cold water, which may give some definite facts on the subject. In the winter time the warm water is rather an advantage, as it assists to keep up the temperature of the soil, but in summer this is not necessary, and if the water is applied at a temperature much above that of the soil, say 100° Fah., there is a danger of scalding. The term "scalding" is often erroneously applied to bare patches where the crop has really been drowned, but this so-called scalding effect can be just as easily produced with cold water. In regard to the small quantity of sulphurous gas in some bore-water, it is doubtful if any of it comes into contact with the plants; where the water has to travel a few miles through drains it becomes sufficiently cooled and aerated before reaching the irrigated ground. Some people consider that by this method the quantity of soluble salts in the water is reduced; but it is not so, for it is evident that even if sea-water was run for hundreds of miles through channels, it would never become fresh, but rather more saline, from loss of water by evaporation. When bore-water is allowed to stand for any time in water-holes, it sometimes becomes bad or "rotten." This may be partly due to want of oxygen, but is more frequently caused by the concentrated extract of soda extracting the tannin and colouring matter from the gum leaves and rubbish, in the same way as it acts upon tea leaves. If considered necessary to cool the water, the method need not be very elaborate, as an elbow on the bore head to turn the stream upwards on to a high slab or projecting log will cause an effective shower. (See illustration at beginning of article.)

Preparing the Land.

Having succeeded in bringing the water on to the highest point of the land, it is most important for the land to be properly graded and levelled. Under the rough-and-ready methods sometimes permissible on western holdings, the first crop can be sown on the virgin plain, and the lumps and hollows found with the water when irrigating. After the crop has been harvested, the bare spots in the stubble will show where the high and low spots are, and these can then be scraped off or filled up without any sighting. However, this is only a make-shift method, and it is more economical to properly level the land before sowing any crops. Irrigating uneven ground is very unsatisfactory, for not only are there many blank spaces in the crop, caused by too much or too little water, but the operator will have to expend much time and patience, wading knee deep in black mud, to coax the water on to these dry islands. Continual watering of uneven lands makes the low spots very sour and cold, and in time, by drowning the nitrifying bacteria, render them sterile.

To get the levels before applying the water, an A level and plumbob can be used, or a spirit level mounted on a tripod can be cheaply obtained. A staff painted alternately black and white in feet and inches, and a bundle of newly split pegs are necessary. When two parallel sides have been pegged out, the levels between can be sighted with boning rods. Of course, if a dumpy level and a surveyor's staff are obtainable, the work can be more expeditiously performed; but for small areas, the cheaper instruments are sufficient.

For the actual levelling of the soil, various forms of tank scoops can be used; but the most effective implement is the wooden scoop or Buckscraper described in the *Gazette*, March, 1905. This can be made by any handy man at a cost of less than £5 from plans supplied by the Department on application. Some little practice is necessary in working the Buckscraper, and it is advisable to have an assistant to drive the horses until the required knack is obtained. (See "Grading, Hawkesbury Agricultural College," March, 1905, page 283.)

In coupling the horses, they should be far enough away so that the handle when inverted will not strike the heels of the centre horse; but as the scoop when piled up with earth holds a cubic yard, which is rather heavy for three horses, it is therefore found advisable to use four horses, and couple them closer to their work. The final smoothing can be done with a large slab or split log drawn across on edge, or by the land-smoother described in the *Gazette*, page 285, March, 1905.

(*To be continued.*)

Rabbit Poisoning and Bee-farming.

Mr. S. G. Theumack, Binnaway, bee-farmer, writes pointing out the great havoc wrought among his bees by rabbit poisoning in his district. Mr. Theumack lost the greater portion of his hives last year, and as proof that the poison laid for rabbits was the cause, he states that he found the bees dead in hundreds on the trail of the cart, besides many dead in the hives. In all, he lost twenty-six colonies, while his returns fell from £90 to nil. Nor was his case an isolated one, there being many other mixed farmers who can, he says, tell the same sorry story. Not only are bees being destroyed, but the native birds are being completely killed out in some districts, with the inevitable result that blowflies and other noxious insects have become serious pests, and it is hard to say where the matter will end. The complaint is against phosphorus and pollard mainly. This is distributed along a mere scratch in the ground instead of being covered with a layer of soil. If this were done it would be equally good as rabbit poison, less likely to start fires, and certainly less likely to poison bees and small birds.

Water Conservation and Irrigation

F. G. CHOMLEY.

DURING the autumn New South Wales has been fortunate in having bounteous rains from one end of the State to the other. The rain has been most opportune for nearly all classes of rural industries, with the exception of viticulture in some districts, where the rains were a source of loss; but for the main primary industries of sheep-raising, wheat-growing, and dairying the rain was most welcome. The natural grasses in most districts have made rapid growth, securing ample feed for the late autumn and winter. The plentiful supply of green feed will have a marked effect on the milk supply; and should later rains fall, and cold, bleak winds hold off, a good season may be looked forward to with confidence. When Nature is so good, we are apt to forget that Nature is fickle, and that bad times will come again; and it is only flying in the face of Providence to think otherwise. Now is the time to prepare for the inevitable dry time, and it should not be put off a moment longer than it takes to make the preliminary arrangements. When dry weather comes, everyone's thoughts naturally turn to irrigation. It is then, alas! too late to do anything; feed is scarce, and, consequently, horse-work is expensive. Tank-sinking is, perhaps, impossible for want of water at the site, channel-making is almost impossible owing to the hardness of the ground. As soon as ploughing and sowing are over, there is not very much work in many places for the teams. A better time to start any water conservation works or channeling could not be found. So many pastoralists and farmers each summer come face-to-face with a very stubborn fact - the scarcity of water. Many are unfortunately situated as regards natural supply from rivers and permanent creeks; but sufficient rain falls on a great many more places, and nothing but the feeblest attempt is made to store sufficient for a few months' dry weather. How many are there among us who, when their tanks were on the verge of giving out when the recent rains came, declared they would not be caught short again, and have forgotten already how much they were losing from want of sufficient water for the stock? It may safely be said that dry weather is forgotten quicker than anything else. As soon as rain comes, irrigation and water conservation become back numbers.

To improve the feeding capacity of a farm in excess of the number of stock that can be watered is not business. Every farmer can estimate how many head of stock his land will carry, and should provide water accordingly. It would be interesting to know how much dry feed was useless, owing to the tanks in the paddocks giving out during last year. Those who suffered should take time by the forelock, and see to it that it does not happen again.

In this connection it might be pointed out that the evaporation from tanks is greatly increased by the wind, and also that the lower part of a tank is the best holding ground, as a rule; so that, within limits, a deep tank is better than a shallow one. And further, water supplied through troughs by windmills or other motive power, and pumps, goes much farther than when stock are allowed to wade in it. Windmills for small places, and either windmills or oil-engines for large estates, are a most important factor in modern farming practice. The water supplied thus is clean, and there is practically no waste. By many it is believed that pumping is only necessary from wells of great depth; this is a great mistake, for where stock can wade in and foul the water, nothing could be worse, both for the tank and the stock. Where from circumstances that render it imperative to allow the stock to drink direct from the tank, a good approach should be made—either pitched, if stone is available, or slabbed or corduroyed, and the approach fenced in, as should also be the tank. Hurdles can then be placed across the opening, and moved as the water recedes, only leaving sufficient water exposed for the stock to drink at, and not to wade in and foul.

A row of trees planted some distance away from the bank, but inside the surrounding fence, if put in in a good season will make good headway, and will afterwards prevent evaporation being so excessive by acting as a wind-break.

To those who contemplate inaugurating irrigation works, or extending those already in existence, the same necessity for promptness exists.

It can only be suggested, in a few notes like these, that work should be put in hand at once; but sufficient has lately appeared in the *Gazette* to help anyone starting a scheme right away, at the same time it is just as well with an irrigation scheme to go slowly. Every district differs in so many particulars that only general statements can be made. However, the Department of Agriculture is at all times open to supply information if applied to, and will spare no pains to put those in quest of information in the way of getting the best service available. It may be a considerable time before any large national schemes are complete, and even then there are thousands of landholders who will not be benefited; these men will be dependent on their own works and nothing is to be gained by delay. A 3 or 4-acre patch irrigated will yield an immense amount of green-feed, running into many tons of such stuff as sorghum, maize, or lucerne, that to a dairy-farmer would mean—well, every dairy-farmer knows what a bit of green-feed is worth in summer and autumn. A small plant, run by an oil-engine or steam, can now be obtained for a moderate price, and if carefully installed and cared for, will give every satisfaction. Windmills could and should be more used; they are to be had in sizes suitable for all kinds of service, either for deep wells, or to lift from shallow depths yielding a correspondingly larger quantity of water. Even on a large scale, windmills are being largely used in America, and if it pays there it will here too. A steam-engine, unless on a fairly large scheme, runs away with a lot of time, as the boiler must be stoked, which keeps one man or, at least, a boy going;

while an oil-engine will run for hours without attention; or a windmill, if of good design and workmanship, and there are many such built now, will run on the average eight hours a day. With windmills a reservoir is necessary. This, however, need not be a costly affair, but simply made of earth—excavation and bank; the bulk of the water will then be above ground-level, and will be capable of being delivered on to the ground to be irrigated, if placed in a suitable position. This subject was dealt with in the *Gazette*, March, 1906, by Mr. T. W. Seaver, B.E., to which the reader is referred for more detailed information on this important and cheap motive-power. If a small plant to be worked by steam power is contemplated, a direct-acting steam pump and a colonial-type boiler taking long wood, is to be preferred to a centrifugal pump, engine, and boiler. A direct-acting pump will work as long as there is sufficient steam pressure to move the pump. Of course, it will go slower than when a full head of steam is available, but for this reason it can be left while attention is being paid to the distribution of the water. With a centrifugal to get a good flow the same regular speed should be maintained, and this is not achieved by intermittent attention. On a large scheme, it is a question for engineering advice—capital cost, cost of fuel, wages, and lift, being factors to be taken into consideration, which, of course, cannot be decided without thorough investigation by a competent person. Manufacturers of one type claim advantages over the other, and naturally so; therefore get independent advice. it will come cheaper in the end. The best time to remove silt from tanks is when there is plenty of water. With a properly-made silt-scoop and gear, cleaning a tank while full is a simple matter compared to cleaning out mud from a dry tank; it is questionable if it is not cheaper to scoop a new tank in dry earth than to clean out mud. There are several very good silt scoops on the market, and where the size of the holding warrants, a plant suitable to the requirements should be found; for tank cleaning a good deal of horse or bullock power is required; it is therefore essential that this work be done in the off season, and during the period when grass is plentiful. All the ditches leading to the tank should be put in order, as should also be the small settling tank into which the catchment ditches run before the water finds its way into the main tank. If the tank is formed in a watercourse by means of a dam, see that the by-wash is in order, and not full of fallen timber, grass, &c.; if this is neglected, the water not being able to get away fast enough, may go over the bank with disastrous consequences. In the case of a dam being made with lower ground available beyond it, a pipe with a ball-cock and trough will be the most economical way of using the water for stock, the whole dam and water-covered area being fenced off.

In the July, 1904, *Gazette*, Mr. T. W. Seaver contributed an article on "Dams." This is an important subject in this connection and should be referred to by anyone contemplating work in this direction. Several articles have been contributed by Mr. W. J. Allen, to which reference should be made for practical information regarding the subject of irrigation on orchard, garden, and farm.

Hawkesbury Agricultural College and Experimental Farm.

Fourth Annual Egg-laying Competition—Winter and Summer Test—1st April, 1905, to 31st March, 1906.

D. S. THOMPSON,
Poultry Expert, Hawkesbury Agricultural College.

The fourth annual test, just completed at the College, was the most successful in every respect of the series yet held. It outdistanced all its predecessors in the matter of egg-production, the final record being a great achievement in the extraordinary output of the winning pen, and in the increase in the general average from 130 eggs per hen in the first year to 166 eggs per hen in the fourth. The average of $1{,}411 \div 6 = 233{\cdot}5$ eggs per hen for the winning pen, and the creditable total average of 166 eggs per hen for twelve months' laying, from 600 hens, will, no doubt, be looked upon as

Winning Pen, White Leghorns (1,411 eggs).
L. S. Tuck, Moruya.

very good records in both England and America. The report of our first and second annual competitions was received very favourably in both countries.

In speaking of egg-laying records in America from private sources, E. L. C. Morse states, in *Commercial Poultry*:—"A gentleman named Silberstein used to furnish us with hair-raising statistics of the number of eggs his Brahmas used to lay; and Brahmas are not generally considered prolific layers; but his laid eggs every day in the year." And so there are many claims from

private sources of outdistancing 200 eggs per annum. But here are a few authenticated official records :--

Bulletin No. 211. Cornell University Agricultural Experiment Station—three flocks. Flock A was composed entirely of White Leghorns, and numbered 508 hens; total number of eggs produced for the year, 59,445; average number of eggs per hen, 116·9. Flocks B and C consisted of 289 White Leghorns, and produced 39,813 eggs, or an average per hen of 137·4. And flock K consisted of 308 White Leghorns and White Wyandottes, and produced 41,641 eggs, or an average per hen of 134·8. It will be seen, says the *Bulletin*, that the average, 129·7 per hen from the whole three flocks, is much less than that often claimed, inasmuch as these flocks represent the better class of poultrymen, and the fowls were, in all probability, better fed and cared for than average flocks. It would seem that all claimed records of more than 150 eggs per hen per year should be abundantly verified before being accepted. Here, again, at Maine Agricultural Experiment Station, where they have been trap-nesting for years, 53 Barred Rock hens averaged 150 eggs per hen per annum; and 40 White Wyandottes averaged 118 eggs; 80 Barred Rocks averaged 132 eggs; 80 White Wyandottes averaged 123 eggs; 20 Light Brahmas averaged 101 eggs. A second lot of 100 Barred Rocks averaged 132 eggs, while a second lot of White Wyandottes, 90 hens, averaged 124 eggs per hen per annum. Out of the 370 hens 55 died during the twelve months, showing 15 per cent.

Nest, showing cover flap.

Our record, then, may be looked upon as very creditable. What conduced to this was, undoubtedly, the extra fine quality of the pullets sent forward for competition from the various breeders. In relation to this, the following remarks were published in the first month's report:—"The 600 pullets sent in by the various competitors are all splendid specimens of the breed they represent. For type, health, vigour, and maturity, it would be hard to excel them." With the excellent laying quality of the stock sent in, it was only necessary to yard them well, house them well, feed them well, and with regularity of feeding and constant attention to details, to produce the average yield already stated.

Weather Conditions.

The weather conditions right throughout the test were favourable on the whole to excellent egg-production. Certainly bad weather was experienced

at times. At the commencement, there was a continuous rain for five days, which told considerably against a good start, the more particularly as the hens were unhoused for some time previous to taking their places in the competition pens. As the competitions follow each other without any break, and the same pens are required, it will be well understood with what a severe handicap the first month's output has to contend against. Anyone who understands what a flying bicycle start means will understand the difference of having hens penned some weeks before entering on the competition, and starting off to count the eggs before the hens are properly located in their pens.

For the winter, dry weather was experienced, but very cold and frosty, no less than fifty-seven frosts being recorded for June, July, and August, while for the whole quarter only 94 points of rain fell. The winter season was a record dry one and the results in egg-production good, with an enormous

Second Pen, Silver Wyandottes (1,303 eggs).
G. Howell, Wentworthville.

increase over the egg-production of the previous year, which was a record for wet weather, for many of the pens were flooded for some time.

The worst feature of the meteorological conditions was experienced in January, the heat throughout the month being exceptionally trying. The thermometer showed many high readings, but the culminating point was reached on the 24th, when the glass showed 112·6° F. at the College Observatory. The temperature was found to be too great a strain on the hens; many of them died from heat apoplexy and from distention of the oviduct, which causes instant death.

Mortality and Disease.

Practically, no disease was met with during the twelve months. The deaths numbered fifty-four, or 9 per cent., and thirty-two of these were from the immediate cause of the exceptional heat-wave. No contagious or infectious

disease occurred. One hen died of liver disease, one from distended crop, while four were killed by native cats, the balance of sixteen hens died from ovarian troubles.

The common disease of scaly leg (*Sarcoptes mutans*), which was a source of great trouble in the early competitions, and which, by the necessary handling of the fowls to oil the legs, necessarily diminished the egg supply, is now rarely met with. The following circular was issued to all intending competitors, demonstrating that prevention is better than cure :—"From experience among the egg-laying competition hens, it has been found that it is necessary, to get the best result in eggs, to interfere as little as possible in the way of oiling hens' legs for the cure of scale. Invariably, it has been found to reduce the output of the hens which have frequently had their legs dressed. The parasites are evidently on the leg, though dormant, long before they

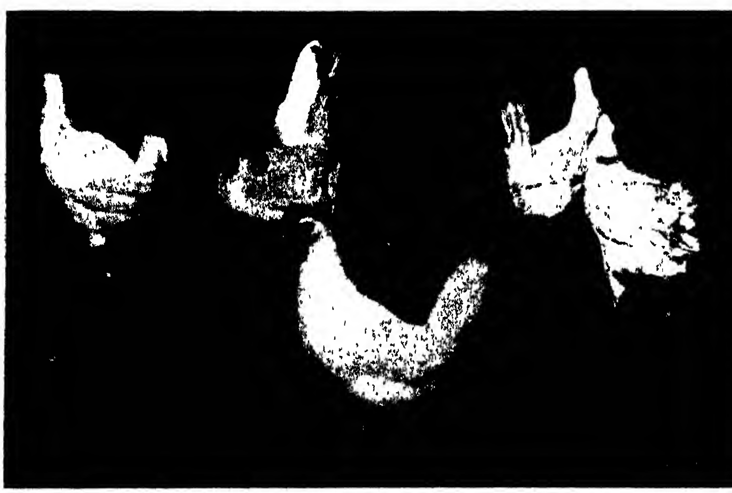
Third Pen, Imperials (1,251 eggs).
H. C Cox, Canterbury.

become active and show results, and I would suggest that the entrants for the next and following competitions, dress the legs frequently before sending them to the College." This has been done, and very little trouble is now experienced.

The commencement of the annual laying competitions is at a time just after the months when most diseases are rife in poultry yards. In an issue of the *Daily Telegraph* in July, Mrs. Douglas, of Fairfield, advanced the following hypothesis relating to unseasonable moulting :—"In regard to the out-of-season moulting in May and June by pullets in the egg-laying competition," Mrs. Douglas writes, "it is well known that chicken-pox (warts) was unusually prevalent these last two autumns, and we have noticed that birds affected by it frequently go into an out-of-date moult. The birds do not

necessarily show any warts or outbreak, but the pullets almost invariably stop laying. If the disease passes quickly they may begin to lay again within about a fortnight, but if a moult follows, the laying is, of course, hindered for quite a long period. At the time our birds were sent to the Hawkesbury College the flock they were taken from showed no sign of anything wrong, being in first-class condition, and either laying or looking near it. Two or three weeks later the pullets began to show signs of chicken-pox, and the laying went down to almost nothing. Many of them were laying in a very short time, but some went into moult, and were a long while before they started again; and I am inclined to think this must be what has happened to their sisters at the College."

There is, undoubtedly, a great deal of truth in the suggestion, and it would be well for all future entrants to, in February and early March, put the intending competitors through a course of Epsom salts, afterwards toning



Fourth Pen, White Leghorns (1,247 eggs).
J. Stewart, Berowra.

up the system with a tonic, such as sulphate of iron, in the drinking water. This would, undoubtedly, be the means of checking a derangement of the blood on being moved to a different climate and, perhaps, change of food.

Another trouble which is put down as a disease, viz., egg-eating, is sometimes found, or is supposed to be found, a source of trouble where there is a large production of eggs.

A correspondent asked a question in the *Daily Telegraph* in regard to whether egg-eating by the hens had been found any trouble at the Hawkesbury College, and received the following reply:—"There have be no cases of egg-eating in connection with any of our egg-laying competitions. If such did at any time occur, the culprit, on discovery, would be at once returned to the owner. The yards are roomy and open, 87 feet by 17 feet, and practically the whole surface is covered with grass. The houses are also roomy,

open and light, the house being 11 feet x 6 feet, with a floor space of 6 feet x $5\frac{1}{2}$ feet for each pen, and an additional floor-space of 6 feet x 3 feet adjoining the house around the nest-box. The nest-boxes are large, with a floor space of 24 inches x 16 inches, and with a natural bottom of loose sand, covered with soft hay or straw. To these facts may be attributed the good fortune in having had no cases of egg-eating."

During the whole course of my experience of thirty-five years in Scotland, England, and in Australia, I have only seen one case of egg-eating. I have witnessed hens eating eggs frequently, but that was when an egg was accidentally broken, and which is not egg-eating. No. 3 stud pen at the College, Northup, Giant Minorcas, laying a 3-ounce egg, have been fed on broken eggs for years, and a whole egg is as safe in that pen, if not safer, than any other pen on the College. Feather eating is a disease which is troublesome, but which we at present do not understand, and shall be glad when someone makes the discovery of how to account for it and prevent it.

Fifth Pen, Golden Wyandottes (1,222 eggs).
W. H. Peters, Waratah.

Feeding.

The system of feeding followed in previous tests was not departed from, it being in conformity with the simple methods of the ordinary poultry farmers. The birds were fed with exact regularity, which is part of the battle. At 7 a.m. they were fed with bran and pollard mash, the mash being more largely composed of pollard, and mixed up with ordinary cold water in the warm weather and hot water in the cold weather, twice per week. The mash is mixed with soup warm from the boiled ox liver. At 10 a.m. green stuff is fed daily, rape when in season and lucerne chaffed, and all fed green. The grain feeding was about equal in quantity of the chief staple grains, wheat and maize, the maize crushed, the maize feeding preponderating through the cold weather, and less maize and more wheat throughout the warm weather.

This is again a good demonstration that maize can be fed to laying hens with good results in egg production. Last year a number of published criticisms showed that the advocacy of the use of maize in feeding is still misunderstood. Although the feeding quantities of bran, pollard, wheat, crushed maize, and meat, besides an unmeasured quantity of green food, have been always given, some breeders have shown that the remarks on feeding were read by them as to conclude that the hens received nothing but maize at every meal throughout the year, while the quantities stated show that maize has only formed from one-eighth to one-fourth of the bulk of the diet in three competitions, while for 1903–4 when maize was fed most largely, owing to the price of wheat being double that of maize, it never reached 50 per cent. of the bulk feeding.

Then why the necessity of writing on maize feeding?

Eighth Pen, Black Orpingtons. First for general utility; weight, 6 hens, 38½ lb.
H. E. Kelly, Ashfield.

Notwithstanding critics now, before these egg-laying competitions started, the general cry with Press writers in England, America, and Australia was, "Do not feed maize," while at the same time we are aware of the fact, that thousands of people in Australia, at least, were feeding poultry exclusively on maize. To show that this has been the case in England and America the following quotations may be permitted:—*The Farmer and Stockbreeder* (England)—"For poultry in confinement there is nothing better than oats. Buy a good oat, a short thick oat of the best quality obtainable. Let this be the staple food, and vary it by giving two or three times a week a little English wheat, barley, or buckwheat, and no Indian corn whatever," quotation recent date, January 2, 1905. In regard to America, the following quotation can be taken as accurate in regard to maize-feeding. Mr. Miller Purvis, writing to the organising secretary of the College Egg-laying Competition, says:—"The most gratifying thing to me is the fact that

Mr. Thompson takes such strong ground in favour of maize as a feed for laying hens. For twenty years I have been fighting for this great cereal, and have had much opposition. When I first came out as a poultry breeder, the best authorities in this country declared that hens fed on any considerable quantity of maize would cease to lay. I disputed this, and have fought along that line, until I have about converted the country." That was in the greatest maize-producing country in the world. It will take much longer to convert England, and the most of our writers take their ideas or learn poultry from English sources.

There is no necessity to re-quote Australian adverse opinions; everyone knows that the general advice always given was, "Don't feed maize, it is too fattening."

Many scientific experiments, combined with practical, have been carried out in America in relation to poultry-feeding. One of the most important, most elaborate, and most concise was carried out by Mr. E. W. Brown, Ph.D., and prepared under the supervision of Mr. E. A. de Schweinitz, Ph.D., Chief of the Biochemic Division of the Bureau of Animal Industry of the United States of America.

The following quotations, taken from the pamphlet, "Digestive Experiments with Poultry," go to show that our advocacy of maize feeding is fully justified:—

"The organic matter of corn is digested to a greater extent than was observed in any of the other foods. The digestive coefficients for crude proteid possess the highest value in the case of maize and peas. There are but slight variations in this value as regards oats, wheat, and barley. The digestive coefficient for ether extract is approximately the same value for maize, oats, and peas, and a point of interest brought out that calls for mention is the conspicuously inferior absorption of the ether extract of both rye and wheat. This is particularly significant when associated with the fact that the percentage content of fat itself is very low in rye and wheat." Again: "With reference to the use of the three grains in combined diet (maize, wheat, and oats), the following suggestions appear warranted:— Maize may be used to contribute a large proportion of any of the three nutrients, but more particularly of ether extract and nitrogen-free extract. The impression prevails among many poultry men that the excessive or liberal feeding of corn is too fattening, unless the bird is being specifically fed for that purpose. It is further thought that injurious effects are apt to follow if the birds are not given a free range."

"Our observations do not corroborate this opinion, as no untoward results followed the exclusive use of maize. However, the nutritive ratio may be too wide when egg-production is the object in view. The lack of palatability of wheat would probably be greatly reduced, or might be overcome, in properly-combined ratios. Wheat may be introduced into the dietary for the crude proteid and nitrogen-free extract. The deficiency of fat in the wheat may be supplied by that of maize, and under the latter condition, it is possible that the untoward effects of the ingestion of liberal quantities of

wheat would be avoided. The results here recorded may offer at least a partial explanation of apparent confusion of results in dietary experiments with certain so-called wide and narrow rations. Thus, a diet of wide nutritive ratio may serve the purpose of a ration of narrow ratio, with more satisfactory results than the narrow ration itself. This apparently contradictory outcome indicates the fallacy of basing the digestibility on chemical composition. Thus, the food containing the smaller quantity of proteid or fat has yielded larger quantities of the nutrients, owing to higher digestibility or palatability, or both.

Here is the summary of the whole of these exhaustive experiments:—

1. Maize, oats. and wheat show marked differences in the digestibility of several of their respective nutrients.
2. The crude proteid and nitrogen free extract are assimilated in much greater proportion in maize than in oats. The digestive coefficient for the crude proteid of wheat is intermediate in value between the average results for maize and oats.
3. The availability of the crude fat of maize is slightly greater than that of oats.
4. The digestibility of the crude fat of wheat is conspicuously less than that of maize and oats. This fact may, at least in part, account for the untoward results of a sole wheat diet.
5. Chickens consume a much greater quantity of maize than oats—an important fact to be kept in mind in a comparison of the digestive coefficients of the two grains.
6. The nutritive superiority of maize over oats is indicated by the body weight. An increase is manifested under the use of maize, while a tendency in the opposite direction is seen with oats.
7. The nutrients of maize are fed at a lower cost than those of oats and wheat. The last-named grain is the most costly of the three foods. This conclusion is based on the actual availability of the various nutrients of the grains.
8. Regarding the application of these grains in mixed dietaries, the following suggestions are offered:—Maize may be included in the main nutrients—that is, crude proteid, nitrogen free extract, and ether extract. Oats may be utilised for the crude proteid and ether extract. Wheat may be employed for the crude proteid and nitrogen free extract, but adequate provision must be made for the deficient yield of this grain in fat.
9. The proteid and fat of beef show high coefficients of digestibility; the former is considerably higher, the latter but slightly less than the corresponding nutrients in maize."

On reference to pamphlet, "Miscellaneous Publication, No. 746," May, 1904, issued by the Department of Agriculture of New South Wales, on the "Second Annual International Egg-laying Competition," on pages 4 and 5 will be found recommendations in feeding obtained only from practical experience, which agrees on the whole with the results summarised from

these exhaustive scientific and practical experiments. At these results no one can cavil, and they will certainly prove interesting to those who applaud wheat feeding and decry maize.

General Attention.

Next to regular and systematic feeding comes the general attention to the pens. The houses are kept scrupulously clean, and are well-ventilated, with plenty of sunlight. Swinging roosts and no lumber of any kind in the houses—nothing but the bare floor space, with the swinging roosts just overhead, about 18 inches from the ground-floor, which is the natural soil foundation. The roosts are occasionally oiled with crude kerosene, and no vermin is at any time visible in any of the houses. The nest-box is placed outside, and is bottomless. It has hay or straw placed on the natural sandy earth foundation, and the litter is renewed frequently. Tobacco dust or crushed tobacco leaf is strewn in the nest, and it acts as a powerful insecticide, while it does not interfere with the nesting of the hens in any way. The water is renewed daily, and the receptacle cleaned out once a week. The eggs are gathered daily at 3 p.m., and all broodiness at once discovered. The culprits are taken from the nest promptly, and broken off by confinement behind a wire fence at the rear of the original pen, where they can see their comrades. They occupy their time by running backwards and forwards, looking through the wire until, anxiety being so great, they leave off the brood, and in two days are admitted to their pens, where they generally commence to lay again. The least neglect of the application of this rule would cause the loss of a large number of eggs from the sitting varieties.

The Egg Market.

In the report of the first annual laying competition, and the first held in Australasia, it was stated that the desire of the Committee was to make the competition a source of education to poultry-keepers, and to show the world the high standard the industry had attained in New South Wales. Both of these objects have been attained; the poultry-keepers have received valuable lessons in many ways, and have not been slow to benefit by their adoption. Before the competition started, the *Daily Telegraph* drew the attention of the public to the fact that New South Wales was importing annually from £20,000 to £30,000 worth of eggs, which were sold in our markets at good, payable prices to the importers. Since then the poultry-breeders have largely increased the egg-production of the State; but still there is plenty of room to increase, as the importations of eggs into this State are still of big proportions, as the following table, taken from the recent report of Mr. H. V. Jackson on the "Poultry Industry," shows:—

"Imports of Eggs from other States into New South Wales.

"1903, £45,972. 1904, £49,075. 1905, £37,752."

So that it will be seen that egg-production has a splendid future before it in this State.

The egg-laying competitions have undoubtedly increased the production of eggs very much. Many people thought that the effects of the booming of egg-production would paralyse our egg market, and that eggs would be a drug in the market. The competitions have not done this, but they have shown poultry-breeders how to increase their egg-yield, and get a maximum of return from a minimum expenditure of labour and food. Early breeding has become general instead of exceptional, and the greatest increase has been in winter eggs. Good egg-producing strains are fast becoming disseminated throughout the whole of the State, and the market remains as good as ever, with still £40,000 or £50,000 worth of our own State trade to capture. The formation of small co-operative egg societies on the northern rivers, if only of ten or twenty members, for the daily collection and forwarding of eggs to the Sydney market, under modern methods, would increase the income of the poultry-farmers on those rivers. The egg-laying competitions have broken down the old methods and substituted the new. The old method, which is still continued on all our general farms to-day; the new methods brought out by the egg-laying competitions only as yet have been adopted by the specialist poultry-farmer. The general farmer allows all his poultry to run promiscuously together, in numbers and in sexes, and to roost anywhere and to lay anywhere. The old method means losing money, from the fact that the fowls are at times overfed and at other times underfed. Both produces low returns and encourages disease, and the results from the ledger spells loss. If the general farmer would only realise this, and either mend his ways or give up keeping poultry altogether, he would be doing a vast service to himself and the State. The old method allows the fowls to roost anywhere and everywhere, and this means that no eggs can be had in the winter time. Eggs, 2s., 2s. 6d., and 3s. per dozen, and none even for themselves to eat. If they wish to have some eggs for breakfast, or entertain some friends, they have to purchase them at the country store for 2s. or 3s. per dozen, while in the summer-time they will have eggs laying all over the farm, which will not pay them to handle and pay freight to Sydney. This means keeping poultry for loss.

The competitions have demonstrated that dividing them up into small lots, providing them with good shelter from the wind and rain, and with plenty of good seasonable food, varied in character, and with good breeds and good strains and early breeding, and breeding every year, you can turn the loss into large profits.

The competition for 1905-6 was run under the following rules and executive :—

Committee of Management.—Mr. W. S. Campbell (Director of Agriculture), Mr. H. W. Potts (Principal, H. A. College), Mr. D. S. Thompson (Poultry Expert, H. A. College), Mr. A. A. Dunnicliff, jun. (*The Daily Telegraph*); Messrs. E. Waldron, W. Harris, A. E. Henry, F. L. Martin, and L. L. Ramsay (competitors' representatives).

Competition Rules.

1. The competition to extend over the period from April 1, 1905, to March 31, 1906, inclusive; competitors to deliver their birds at the Hawkesbury Agricultural College, between March 1 and 24, inclusive.

2. Each pen to consist of six pure-bred pullets, not less than seven months or more than twelve months old on April 1, 1905. No male bird to be included.
3. All birds to be bred by and to be the property of the competitor.
4. The poultry expert is empowered to reject any bird or birds that he does not consider of correct age. Any rejected bird must be replaced by the competitor with another of suitable age.
5. The birds upon being accepted by the poultry expert as being of suitable age, no protest will be entertained upon that point.
6. Any bird found to be suffering from an infectious or contagious disease, when delivered at the College, to be rejected and replaced by the competitor.
7. The poultry expert shall reject any bird that is not a fair specimen of the breed entered, and such bird must be replaced.
8. One wing of each pullet must be cut by the owner before forwarding to the College. The wing will be kept cut during the currency of the competition.
9. In the event of a bird dying, becoming diseased, or incapacitated from laying, the competitor must replace it with another of the same age and breed, upon being notified.
10. All eggs to become the property of the Department of Agriculture.
11. Eggs under $1\frac{1}{2}$ oz. in weight or otherwise unmarketable not to be counted.
12. Any pen, the eggs from which do not attain an average weight of 23 oz. per dozen after the first three months of the competition, to be ineligible for a prize.
13. The competition to be decided by the total number of eggs laid by each pen.
14. The market value of the eggs from each pen to be recorded, and prizes given for the greatest total value.
15. Prizes to be given for a winter test to extend over the first four months of the competition.
16. Records to be kept of the total quantities of the various foods consumed, and the average cost per head.
17. No competitor to be allowed to withdraw any bird until the termination of the competition.
18. Any competitor violating or failing to conform to these regulations will be subject to such disqualification as the committee may think fit.
19. The committee's decision in all matters of dispute to be final.

The following is a *resumé* of the general report, appearing in the *Daily Telegraph*, 4th April, 1906:—

EGG-LAYING COMPETITION AT HAWKESBURY COLLEGE.

FOURTH ANNUAL TEST.

The Prize Winners.

The prize money, which totalled £111, was won as follows, only pens laying eggs averaging at least 23 oz. per dozen being eligible:—

Number of eggs in the twelve months:—

	£	s.	d.		£	s.	d.
1. L. S. Luck ..	10	0	0	11. A. J. Laraghy	1	0	0
2. G. Howell	7	0	0	12. A. F. Emmott . ..	1	0	0
3. W. C. Cox	5	0	0	13. W. E. Boutcher	1	0	0
4. J. Stewart	4	10	0	14. L. L. Ramsay .. .	1	0	0
5. W. H. Peters	4	0	0	15. E. W. Hyndman	1	0	0
6. Johnson Brothers and Mrs. Every (equal), each	3	5	0	16. T. A. Hutchinson ...	1	0	0
				17. Invercoe Poultry Farm .	0	10	0
8. H. E. Kelly	2	10	0	18. D. Fraser	0	10	0
9. J. W. Woodland ..	2	0	0	19. L. W. Nicholson	0	10	0
10. S. Wade, junior .	1	10	0	20. J. Lowe	0	10	0

Aggregate market value in the twelve months:—

	£	s.	d.		£	s.	d.
1. L. S. Luck	4	0	0	5. W. H. Peters	1	10	0
2. G. Howell	3	0	0	6. Johnson Brothers ..	1	0	0
3. W. C. Cox	2	10	0	7. A. J. Laraghy	0	10	0
4. S. Wade, junior ...	2	0	0	8. H. E. Kelly	0	10	0

Winter test (first four months):—

	£	s.	d.
1. G. Howell ...	5	0	0
2. L. S. Luck ...	4	0	0
3. Mrs. E. Scaysbrook ...	3	0	0
4. D. Fraser... ...	2	10	0
5. S. Wade, junior ...	2	0	0
6. E. J. Turnbull ...	1	10	0
7. Ventura Poultry Farm ...	1	0	0
8. W. H. Peters ...	0	10	0
9. W. C. Cox ...	0	10	0

Last three months (moulting period):—

	£	s.	d.
1. G. Howell, 341 eggs ...	2	0	0
2. J. W. Woodland, 312 eggs	1	10	0
3. J. Stewart, 292 eggs ...	1	0	0
4. L. S. Luck and Johnson Brothers, 290 eggs (equal) each ...	0	5	0

General Utility Prizes (open to hens averaging at least 6 lb. in weight on 1st March, 1906, and laying eggs averaging not less than 24 oz. per dozen, to be decided by the number of eggs laid):—

	£	s.	d.
1. H. E. Kelly, total, 38½lb. weight ...	2	0	0
2. S. Wade, junior, 38lb. weight ...	1	10	0
3. L. L. Ramsay, 37½lb. weight ...	1	0	0
4. W. H. Ponton, 39¼lb. weight ...	0	10	0

Most eggs first month:—

	£	s.	d.
1. L. S. Luck ...	2	0	0
2. E. J. Turnbull ..	1	10	0
3. H. E. Kelly ..	0	10	0

Monthly Prize of £1 for the most eggs from a pen (April excepted):—

May, G. Howell ...	105 eggs.
June, G. Howell ...	135 ,,
July, G. Howell and A. J. Laraghy (equal) ..	144 ,,
August, D. Fraser.. ...	168 ,,
September, L. S. Luck and J. Stewart (equal) ...	149 ,,
October, L. S. Luck	151 eggs.
November, L. S. Luck	145 ,,
December, J. Stewart ..	146 ,,
January, Johnson Brothers and J. W. Woodland (equal)	125 ,,
February, G. Howell ..	124 ,,
March, G. Howell	114 ,,

Comparison of Results.

The following compares the results of the four competitions.

	1902-3.	1903-4.	1904-5.	1905-6.
Number of pens ...	38	70	100	100
Winning pen's total ...	1,113	1,308	1,224	1,411
Lowest pen's total ..	459	666	532	635
Highest monthly total ...	137	160	154	168
Average laying per hen ..	130	163	152	166
Greatest value of eggs ...	£7/0/3	£7/10/4	£5/13/10	£6/5/6
Average price of eggs ...	1/1	1/3¾	1/-	-/11½
Average value of eggs per hen ...	15/6	17/9½	12/9	13/3¼
Cost of feed per hen	6/-	5/9¾	4/5½	5/3½
Profit over feed per hen ...	9/6	11/11¾	8/3½	8/-

The analyses of the average production of, and the value of the eggs laid by, the various breeds are as follows :—

Breed.	Per Hen—Eggs.	Per Hen—Value.
12 Imperials ...	200·83	16/10
6 Black Hamburgs ...	197·50	15/11
12 Langshans ...	184·08	14/5
42 S. C. Brown Leghorns	179 52	14/–
12 Andalusians	179·08	14/2
12 Golden Wyandottes	178·08	14/4
12 R. C. White Leghorns ...	173·58	13/9
6 Faverolles ...	173·33	13/
24 Buff Leghorns ...	171·29	13/4
18 R. C. Brown Leghorns	169·66	13/3
120 S. C. White Leghorns	167 90	13/–
120 Silver Wyandottes	165 77	14/5
114 Black Orpingtons ..	158·01	12/9
30 Buff Orpingtons	157·56	12/7
12 White Wyandottes	149·58	11/6
18 Minorcas ...	147·50	10/6
12 Buff Wyandottes	146·66	11/6
6 Campines	146·16	10/9
6 Anconas	132·00	10/2
6 O. E. Game	129·50	8/4

Records and Financial Result.

The prices for foodstuffs were higher than for the previous year, the prices being for 1904-5, bran, 9d. ; pollard, 9½d. ; wheat, 3s. 4d. ; maize, 2s. 6d. ; while for 1905-6 they were : Bran, 9d. ; pollard, 1s. 1d. ; wheat, 3s. 5d. ; and maize, 3s. 10d. The cost of feeding the 600 hens at those prices was : Wheat, £42 14s. 2d. ; maize, £39. 9s. 8d. ; bran and pollard, £49 3s. 9d. ; meat, £17 8s. ; green-stuff, £7 ; and shell-grit, £3. Total, £158 15s. 7d.

The monthly laying was : April, 3,134 ; May, 3,912 ; June, 7,292 ; July, 10,180 ; August, 12,839 ; September, 11,987 ; October, 11,774 ; November, 9,308 ; December, 9,092 ; January, 7,957 ; February, 6,704 ; and March, 5,378. Grand total, 99,553 eggs, or 8,296 dozen.

The monthly range of prices for first-grade eggs was : April, 1s. 6d. to 2s. ; May, 1s. 11d. to 1s. 10d. ; June, 1s. 9d. to 1s. 1d. ; July, 1s. 1d. to 11d. ; August, 10½d. to 8d. ; September, 8d. to 7¾d. ; October, 7½d to 6½d. ; November, 7d. to 9½d. ; December, 9d. to 1s. ; January, 10d. to 1s. 3d. ; February, 1s. 2d. to 1s. 4d. ; March, 1s. 4d. to 1s. 7d.

The net market value of the eggs was £398 15s., from which deduct the cost of feed, £159 15s., and a surplus of £239 remains.

The appended table gives full details of the eggs laid, and the net market value of the eggs from each hen.

Eggs laid, and net market value of the eggs from each hen.

Owner, Address, and Breed.	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Totals.	Weight per doz.	Market Value.
														oz.	
1. L. S. Luck, Moruya: White Leghorns	122	86	107	99	143	149	151	145	119	118	102	70	1411	25	125/6
2. G. Howell, Wentworthville: Silver Wyandottes	49	105	135	144	112	118	106	100	93	103	124	114	1303	25¼	120/9
3. W. C. Cox, Canterbury: Imperials	56	63	120	117	153	129	144	132	125	106	43	63	1251	24	106/9
4. J. Stewart, Berowra: White Leghorns	77	14	36	109	149	149	142	133	146	122	91	79	1247	26	100/-
5. W. H. Peters, Waratah: Golden Wyandottes	47	72	106	132	118	123	131	118	101	74	98	102	1222	28	101/9
6. Mrs. Every, Graham's Valley: White Leghorns	46	51	77	103	137	144	123	134	138	98	100	54	1205	24	95/-
7. Johnson Bros., Marsfield: White Leghorns	66	45	48	105	144	140	117	117	133	125	86	79	1205	25¼	100/5
8. H. E. Kelly, Ashfield: Black Orpingtons	102	52	45	137	147	120	147	118	112	80	77	51	1188	25¼	100/1
9. J. W. Woodland, Penrith: Black Hamburg		38	72	103	135	133	141	121	130	125	95	92	1185	25	89/9
10. Reliable Poultry Farm, Blackwall: R.C. Brown Leghorns	17	65	110	134	124	124	141	107	114	91	89	67	1183	22¼	91/7
11. S. Wade, jun., Tamworth: Silver Wyandottes	84	67	88	131	148	119	129	67	97	81	79	92	1180	25¼	106/-
12. A. J. Laraghy, Singleton: Silver Wyandottes	32	47	117	144	147	140	108	93	103	97	65	83	1176	24	101/2
13. A. F. Emmott, Moruya: Brown Leghorns	45	53	87	118	130	132	140	104	104	111	93	59	1176	24¼	96/9
14. W. E. Boutcher, Canterbury: Imperials	47	100	112	90	127	123	132	104	110	56	88	70	1159	23	96/-
15. L. L. Ramsay, Carlingford: Black Orpingtons	52	69	102	119	128	125	136	110	97	69	73	75	1155	26	98/9
16. E. W. Hyndman, Miranda: White Leghorns			54	131	142	130	143	127	142	123	96	53	1141	25	83/2
17. T. A. Hutchinson, Manly: Brown Leghorns	42	41	47	97	139	141	141	112	130	119	64	59	1132	25	80/8
18. Invercoe Poultry Farm, Plumpton: Brown Leghorns	73		92	108	127	137	139	117	96	97	76	59	1121	24	90/7
19. D. Fraser, Miranda: Langshans	67	80	111	122	168	141	133	93	69	45	38	44	1121	23	88/3
20. L. W. Nicholson, The Oaks: Silver Wyandottes	66	80	100	99	132	127	118	81	91	77	60	82	1113	25	98/9
21. J. Lowe, Baulkham Hills: White Leghorns	4	25	95	118	141	129	131	121	82	101	94	65	1106	25¼	86/4
22. Mrs. Evenden, Camden: Andalusians	40	34	59	111	126	124	141	114	108	106	95	35	1093	27	87/3
23. Grantham Poultry Farm, Plumpton: R. C. W. Leghorns	58	44	70	101	128	114	128	92	100	88	95	70	1088	24	90/5
24. D. Gwynn, Tighe's Hill: Buff Leghorns	41	52	95	123	134	131	119	84	116	77	81	35	1088	22¼	85/7
25. W. H. Ponton, Tuggerah: Langshans	37	39	57	133	139	140	146	112	94	83	74	34	1088	28¼	85/-
26. W. Moss, Riverstone: Brown Leghorns		49	78	118	138	124	138	92	94	84	76	94	1085	24¼	86/9
27. Ventura Poultry Farm, Miranda: Silver Wyandottes	81	86	96	97	119	125	110	73	86	84	61	59	1077	24	97/4
28. E. Gauntlett, Galston: Buff Orpingtons	46	76	98	110	138	124	120	78	74	93	61	47	1062	25¼	91/-
29. A. Baxter, Sans Souci: Buff Leghorns		1	80	136	148	141	135	104	111	84	70	52	1062	23	77/9
30. Veness and Fox, Ashfield: Silver Wyandottes	90	80	78	91	112	118	107	80	90	83	53	75	1057	24¼	95/7
31. G. Speed, Mount Druitt: Andalusians	48		55	105	128	125	141	114	102	87	91	60	1056	28	83/-
32. C. A. Shepherd, Liverpool: Black Orpingtons	10	26	91	125	152	112	128	89	88	80	85	61	1047	26	82/6
33. Mrs. E. Scaysbrook, Gosford: Black Orpingtons	46	100	129	124	136	124	112	88	67	46	42	29	1043	24¼	92/4
34. W. R. G. Walsh, Arcadia: Faverolles			56	118	149	132	134	98	98	96	89	70	1040	25	77/5
35. Turner Bros., Ingleburn: White Leghorns	11	72	102	94	139	115	98	85	99	94	66	64	1039	24	73/2
36. F. McGrath, Albion Park: Black Orpingtons	27	50	114	90	130	122	118	95	76	85	62	69	1038	27	86/6
37. A. P. Sargent, Five Dock: Brown Leghorns	13	49	100	111	133	129	129	91	60	99	81	39	1034	23¼	80/5
38. N. B. Ralston, Fairfield: Buff Orpingtons	53	80	69	99	111	100	109	93	78	86	81	62	1021	25¼	90/6
39. F. J. Brierley, Carlingford: White Leghorns	13	56	100	107	119	126	108	105	106	93	60	28	1021	25	82/9
40. H. Moody, Wyalong: White Leghorns	6		42	102	136	136	143	130	117	94	58	49	1013	26	72/2
41. H. Jones, Canterbury: Silver Wyandottes	40	64	55	108	116	107	110	87	90	76	87	74	1014	24	87/4
42. J. Skinner, Lewisham: R. C. Brown Leghorns	40	31	46	104	123	131	130	106	95	100	76	27	1009	24¼	78/6
43. Royle Poultry Farm, St. Leonards: Black Orpingtons	22	51	98	101	115	123	101	83	89	84	71	67	1005	25¼	84/7
44. G. Mudie, St. Ives: Buff Leghorns	58	69	111	124	158	123	101	60	74	67	29	38	1003	24	85/9

45. Guan Bros., Inverell : Brown Leghorns	1	23	44	77	92	101	124	116	123	125	98	79	1003	27½	79/-
46. H. Robins, Galston : Silver Wyandottes	19	46	105	101	133	119	120	81	74	73	62	62	995	25	81/9
47. W. J. Preddy, Bexley : R. C. White Leghorns		32	83	125	123	115	124	89	99	83	62	60	995	23	75/4
48. E. F. Silcock, Armidale : Silver Wyandottes	48	47	81	124	134	111	97	87	77	71	62	55	994	22	81/9
49. F. J. Wood, Ashfield : Minorcas	22	32	39	115	114	120	129	110	108	96	85	24	994	25½	66/6
50. Mrs. H. Bastin, Enfield : Black Orpingtons	31	39	113	75	130	104	100	97	80	74	84	63	990	25	85/9
51. E. J. Turnbull, Mulgoa : Silver Wyandottes	106	84	87	90	110	105	108	73	72	66	55	33	989	24	90/9
52. Heydon and Shepherd, Brucedale : Brown Leghorns			52	122	126	130	93	112	99	104	87	64	989	24½	74/3
53. S. Kendall, Kiama : Silver Wyandottes		25	73	116	131	108	116	92	101	88	71	56	987	25	78/2
54. Miss L. A. Brown, Waverley : White Wyandottes	22	40	103	121	129	113	106	82	91	52	59	69	987	23	78/1
55. C. Wyberg, Port Kembla : White Leghorns	17	23	52	126	136	132	134	102	110	69	52	31	984	25½	73/7
56. A. E. Henry, Ryde : Silver Wyandottes	42	74	90	94	111	111	101	90	71	58	62	79	983	24	87/5
57. Mrs. H. Tubby, Prospect : Silver Wyandottes	1	22	68	112	132	115	113	99	103	79	84	51	979	24	75/6
58. J. Kelly, Willoughby : Minorcas	15	53	95	108	130	111	115	84	72	73	69	49	974	27	80/-
59. D. James, New Lambton : Black Orpingtons	57	48	105	88	128	114	103	62	61	85	66	49	965	24	79/2
60. Mrs. C. Burke, Naremburn : Silver Wyandottes	58	74	66	99	122	102	102	82	66	78	56	59	964	24	84/8
61. J. Bush, Branxton : Buff Leghorns	22	12	66	94	114	125	126	107	100	93	69	30	958	26½	72/6
62. W. B. Bailey, Miranda : Silver Wyandottes	101	78	80	88	119	91	81	68	73	59	56	63	957	24½	89/7
63. W. Cook, Balmain : Black Orpingtons	61	26	46	110	135	112	121	95	85	69	57	36	953	27½	76/5
64. J. Varley, Rookwood : Buff Orpingtons	19	56	113	96	133	122	105	45	79	69	59	55	951	23½	76/6
65. S. Ellis, Botany : White Leghorns	35	73	53	81	112	123	128	99	88	60	42	44	938	23½	77/7
66. W. Wild, Lake Albert : Black Orpingtons	27	28	70	92	128	105	112	94	89	80	61	50	936	26½	74/7
67. A. J. Byrne, Eastern Creek : White Leghorns	2	29	63	86	103	108	123	107	107	101	69	38	936	25	71/8
68. J. Duncan, Ashfield : White Leghorns		16	90	83	125	125	130	92	96	76	57	33	923	26	69/-
69. R. M. Malbourne, Wyong : Black Orpingtons	50	54	92	106	127	102	89	51	60	57	56	71	915	25	80/7
70. S. W. Rutherford, Canley Vale : Golden Wyandottes	7	25	75	115	124	130	120	80	80	59	54	46	915	25	70/8
71. W. J. Napier, Guildford : White Leghorns	29	74	95	99	136	129	111	85	81	46	13	15	913	23½	69/9
72. F. Edwards, Parramatta : Silver Wyandottes	32	3	42	95	128	115	104	86	87	80	66	74	912	25½	75/7
73. R. E. Warren, Richmond : White Leghorns	6	29	64	105	101	117	103	75	89	93	80	49	911	25	70/6
74. J. Taylor, Gordon : Buff Wyandottes	44	25	23	84	116	120	106	88	84	81	76	62	909	24	73/3
75. E. Waldron, Willoughby : Black Orpingtons			33	85	137	133	104	95	81	88	72	80	908	26½	67/-
76. Mrs. J. Rone, Riverstone : Black Orpingtons			46	116	147	133	109	100	79	75	50	53	908	27	66/2
77. R. Daveney, Croydon : Black Orpingtons	35	54	129	85	140	111	100	66	60	49	37	39	905	25	76/9
78. Mrs. Douglas, Fairfield : White Leghorns		11	17	71	123	133	125	97	84	112	86	40	899	27½	63/9
79. W. H. Jones, Bondi : Black Orpingtons	37	29	54	86	120	95	101	67	96	83	44	82	894	26	73/9
80. P. Lowe, Lower Portland : White Leghorns	3	1	14	52	105	122	141	128	115	93	72	41	887	25	71/-
81. A. McKinnon, Maclean : White Leghorns	38	32	17	29	125	126	127	117	114	87	49	26	887	25	66/5
82. I. F. Godbee, Wentworthville : Silver Wyandottes	29	41	54	46	115	105	128	94	111	60	66	36	885	24	69/7
83. G. Webster, Mullengandra : Silver Wyandottes	14	30	59	84	141	123	112	72	70	58	71	46	880	24	68/3
84. W. L. Andrew, Beecroft : Campines	2	17	58	104	122	113	130	86	95	78	52	20	877	25	64/9
85. J. T. Wilson, Waratah : Buff Orpingtons	4	4	48	127	136	120	119	82	73	52	56	46	867	25	62/1
86. J. S. Oag, St. Ives : R.C. Brown Leghorns	58	62	31	50	109	102	104	82	76	72	64	52	862	22½	68/8
87. Cloverdale Poultry Farm, St. Ives : Buff Wyandottes	9		69	102	124	93	101	63	71	80	62	72	851	24	64/8
88. A. Arnold, Ashfield : White Leghorns	9		30	93	123	105	125	93	78	66	65	61	848	27	60/9
89. Mrs. W. Sidwell, Bowning : Silver Wyandottes	22	64	118	94	104	97	84	45	51	59	60	33	831	23	69/8
90. E. A. Thomas, Inverell : Buff Orpingtons	16	39	65	86	92	96	103	85	70	64	58	52	826	25½	67/6
91. Wickham and Scarr, Roseville : Black Orpingtons	18	24	52	106	112	107	72	77	69	60	57	63	817	25	65/4
92. H. Norrie, Marsfield : Silver Wyandottes			78	84	133	126	111	76	89	59	35	29	820	26½	58/9
93. C. E. Taylor, Rylstone : Black Orpingtons	32	25	100	91	115	90	92	63	57	56	57	35	813	24	67/-
94. J. Wilson, Gladesville : White Wyandottes	10	10	24	69	117	111	95	85	90	82	47	68	808	24½	60/4
95. W. T. Ely, Rydalmere : Black Orpingtons		2	21	104	150	131	112	100	80	44	49	4	797	28	53/9
96. W. Gibson, Penrith : Anconas	24	3	66	95	130	101	87	65	72	64	69	16	792	26½	61/2
97. E. M. Perdriau, Drummoyne : Old English Game	12	19	21	58	130	112	107	86	85	72	43	32	777	23	50/4
98. M. Ward, Gosford : Black Orpingtons		6	68	111	134	102	93	61	55	45	35	21	734	29	54/1
99. G. Holden, Riverstone : Minorcas	8		26	61	134	125	130	101	72	13	14	1	685	25½	42/7
100. H. G. Dennis, Thirlmere : White Leghorns			35	68	125	119	82	79	50	16	30	31	635	26½	44/8

Monthly Weather Report.

HAWKESBURY AGRICULTURAL COLLEGE.

Summary for April, 1906.

Air Pressure (Barometer).			Shade Temperature.				Air Moisture Saturation = 100.			Evaporation (from Water Surface).			
Lowest.	Highest.	Mean.	Lowest.	Highest.	Mean.	Mean for 14 years.	Lowest.	Highest.	Mean.	Most in a Day.	Total for Month.	Monthly Mean for 8 years.	% of the year's Evaporation.
29·89 26th.	30·39 7th.	30 112	36·2 30th.	92·6 15th.	65·621	63·311	40 22nd.	100 14th	68·73	·219 27th.	in. 3·642	in. 3·127	7·9

Rainfall (as recorded).					
Dates	2	6	12	20	Total, Mean rainfall for 14 years = 246 points.
Points..	4½	3½	5	2	15 points.

	N.	N.E.	E.	S.E.	S.	S.W	W.	N.W.
Wind . .	0	2	0	1	3	4	2	6

Greatest daily range of Temperature, 42·7 on 10th.

Days on which Shade Temperature rose above 90° Fahr.—92·6 on 15th; 92·5 on 16th; 92·5 on 17th.

Remarks.—A very dry month. Lowest rainfall recorded for April during past fourteen years (period during which records have been taken). Strong north-westerly winds towards latter end of month.

W. MERVYN CARNE,
Observer.

New Varieties of Plants.

Three varieties belonging to different species.

The Giant Red Demi-sugar Beet.— The root is elongated, of ovoid form, skin red with white flesh. It is very compact, of excellent quality, and keeps well. The plant is also well furnished with foliage. Agriculturists have for some years given marked preference to demi sugar beets cultivated as forage. The new variety belongs to this category. Its qualities fulfil all requirements.

The Red-grained 15th August Maize is an early variety which has become definitely fixed. It is from the yellow 15th August maize, but is much earlier than the latter and has a longer and thicker cob. This variety is, therefore, appreciably more productive. By reason of its extremely rapid development, it will give two crops the same year in the south, if the seed is sown early. In the north, where no other maize will ripen, this alone arrives at maturity.

The White Artichoke, after careful selection for ten years, has now become definitely fixed. It is distinguished from other varieties of the artichoke by its white round tubers, growing in bunches around the root, and for its notably superior yield. Of good quality, with very sweet flesh, it constitutes an excellent food for animals, particularly for horses, especially if combined with hay and other dry foods. Again, it gives, by distillation, a large proportion of alcohol. The green stems form a very good forage for cows and sheep. It also makes a good cover for game. Artichokes flourish without any care in all kinds of soil, and never freeze. They are valuable for the utilisation of poor soils, but do not do well on wet soil with impermeable subsoil.—P. Florent, in the *Journal de l'Agriculture.*

The Rockdale Laying Competition.

G. BRADSHAW.

EGG-LAYING competitions are now the order of the day in Australasia. Incepted in this State some four or five years ago by the *Daily Telegraph* Newspaper Company, they have spread throughout the States of the Commonwealth and New Zealand. The promoters realising that our then egg imports amounted to over £20,000 annually, conceived the idea of offering substantial prizes with the object of encouraging increased egg production by prompting the competitive spirit among market poultry breeders in the same way as prizes at poultry shows encourage improvements in the appearance of the various breeds exhibited there. The very great liberality in the way of substantial prize money and the apportioning of it in so many admirable ways, prompted large and, at each competition, increasing entries beyond even the additional Hawkesbury College accommodation, and culminating in the test which gives the title to this paper.

W. J. Loughman's Black Orpingtons. First prize.

In connection with prizes offered at poultry shows, their effect can be readily seen in every breed exhibited. Possibly in some cases the utility qualities may not be benefited, but the object of fanciers and show authorities, *i.e.*, the appearance, certainly is being attained; indeed, few of the present day fanciers who witnessed the debut of the Wyandottes at the New South Wales Poultry, Pigeon, and Dog Society's Show in the Exhibition buildings in July, 1887, and those which appeared at the late Royal Show, would scarcely recognise the then specimens as even remote representatives of the Wyandotte breed. Having penned one of the pairs, and a three months' prior acquaintance with them, I well remember the up-pointed Hamburg comb, the almost perpendicular tail, while for lacing there was none, only a small white centre in the otherwise black breast feathers, and the saddle was devoid of

white. The fanciers have been responsible for the above change, as they have for the present-day massive Orpingtons, the first importations in 1887 of this breed being neither larger nor better than the bulk of our present-day black nondescripts. Desired attainments have taken place in the bulk of the other breeds, all of which can be seen; but when it comes to advancement in laying, qualities which are not apparent to the eye, the results are more in the region of doubt. This portion of the subject will, however, be dealt with at the end of this paper; suffice at present to say, that whether the laying competitions at present being conducted in Australia will ultimately benefit the industry, depends solely on those whose fowls at the tests have shown superior laying properties.

When the entries closed for the fourth Hawkesbury laying competition, it was found that a considerable number were received beyond the house and run accommodation. The *Daily Telegraph* then, rather than witness so many

H. Fleming's White Leghorns. Second prize.

disappointments, arranged with Mr. J. McIntosh, of Rockdale, an experienced fancier, exhibitor and judge, to take over fifty pens of the surplus. When the matter was finally arranged with the promoters, Mr. McIntosh began operations in the way of erecting houses, runs, &c., and had all ready for the occupants considerably before the date of what turned out to be the record, from every point of view, of all the laying competitions; and to show poultrymen how, with inexpensive appliances, the simplest and cheapest houses and runs, and the ordinary available poultry foods, these extraordinary records were brought about, is the principal object of this paper.

Location.

Rockdale is the name of the suburb in which the competition took place; but the actual location of the test-yards could be more appropriately named "Sand-vale," and is situated in an unpretentious roadway named James-street, off the tram-line to Brighton-le-Sands (Lady Robinson's Beach),

between that seaside resort and the railway-station. Prior to the arrival of the "Endeavour," the entire locality was, no doubt, one of the white sand-flats with which the coast is studded. The settlement of the district soon found the flats adapted to the influence of the spade and hoe—market-gardening and poultry-breeding being the principal industry of the district—with the result that what was once acres of white sand and occasional swamp is now small but prosperous-looking farms and gardens, the continued application of organic matter converting these one-time white acres into sandy loam, this being now the nature of the ground where this competition was to take place.

The houses and runs were, of course, the first consideration, and, Mr. McIntosh's legitimate trade being that of builder, no time was wasted in their construction. But at a very early stage of erection fault was found by several of the entrants, the chief being that the runs were quite too small, and the houses ditto. Mr. McIntosh politely told the grumblers that he was the conductor; and that, being so entrusted, he must decide what size was

J. B. Douglas's Minorcas. Third prize.

most suitable; and that, as the eggs laid would be his only remuneration, his efforts would be directed to best promote that, the chief feature of the test.

When erected, other complaints were made. Some competitors rightly mentioned the absence of shade, while another complained that the pen allotted to his birds was exactly where an old hen-house had been located, and feared disease; while others complained of the lack of shelter from bleak winds.

Coming to the houses and runs. The book theory has been that the larger the runs the better, and when the extent of those at Rockdale were seen to be but 10 x 40 feet for six fowls, including house space, it is no wonder there were discussions, and detracting comparisons made with the 400 superficial feet of hot Rockdale sand, and the more favoured area of 1,479 feet of well-grassed runs at the College. The runs at the number 2 competition are as stated, but 10 x 40 feet, enclosed with 6-foot wire-netting, the absence of male birds in the pen obviating the use of the

orthodox 2-foot paling. The houses have what is known as the span roof, but as the centre of each house forms the dividing line between two runs, each of these houses in reality forms two, resulting in each house being a lean-to. They are built of the ordinary tongued and grooved soft wood, half-inch lining boards, and from front to back are 4 feet, and 3 feet 9 inches across, opening for doorway being 1 foot 9 inches, but whatever the simplicity of construction for roosting and confinement, the furnishings were more so, and consist of a small box to hold grit. The water tin is the usual 2-quart galvanised kitchen dipper, minus a handle. The nest-boxes are insignificance itself, and consist of two strips of wood, 4 or 5 inches deep, and apparently 16 inches long. These are nailed together at the end, forming a half square, which when laid down on edge in a corner of the roosting house, near the door, forms a nest. Nest egg none, and nesting material the merest fragment of hay, and to realise that a pen of Black Orpingtons laid 1,461 eggs, weighing about 1¾ cwt., in this simple enclosure is almost incredible.

D. W. Albone's Silver Wyandottes.

The conductor, when spoken to on the subject of having but one nest to accommodate six laying hens, replied, "Well, you see, they wait on one another, and when they are in a hurry, they don't," and it was on one of the latter occasions when the writer visited the Rockdale farm, witnessing three hens on the one nest.

The balance of the outfit for the comfort of the hens was a few palings nailed together in the form of shutters. These are sawn palings, 6 feet long, the shutter being 2 feet wide, and placed at the back of the houses, which keeps the sand cool and throws off the rain. The place appears to be exposed to all weathers, and certainly would not impress one as an ideal farm on which to put up records. In fact, one competitor visiting the place, and experiencing the severity of a Botany blow, ventured the opinion that even moderate laying could not be expected. It has now been shown that

the place was not too inviting in appearance, the outfit and arrangements most inexpensive. The food next demanding consideration, and the following will show this important feature in poultry-farming, in the conductor's hands appears the simplest of them all. Here is Mr. McIntosh's formula, as supplied to the *Daily Telegraph* :—

Feeding.

"Breakfast was given in the winter about an hour, and in the summer about two hours, after daylight, and consisted of mash, made as follows :—Pollard, about three parts (more or less according to quality) ; chaffed green lucerne or chaffed white clover, the latter for choice, from 15 to 30 per cent. (when neither of these was obtainable, bran was used) ; maize-meal about 5 per cent. This was mixed each morning with boiled liver and the soup therefrom, care being taken to see that the food was not too dry. Three times a week a quantity of rough meadow grass and white clover was thrown into the runs, not so much as green food, but to keep the hens busy scratching, and to act as covering for the otherwise hot, bare sand. As the afternoon feed, good sound wheat was given at about 4 o'clock.

"No general rule was observed as to the quantity of food. Each pen was given as much as the hens would pick up clean—no more—and to be quite sure of this, I went round several times to see that each lot had had their fill. I soon got to know, however, which ones were the big eaters (and the difference in the quantity consumed by some as against others of the same breed was really surprising). The only exception to this practice was that in the winter an extra handful was added to the evening ration for a daylight "picking" next morning. The grit-boxes were cleaned out every week, and a fresh supply given."

The *Sydney Morning Herald's* report adds :—

"Mr. McIntosh only lost nine fowls from the heat-wave and other causes during the competition. His mode of feeding is to give for breakfast three parts of pollard, chaff, green lucerne, or white clover, with a little maize-meal. These are mixed with boiled liver and its soup, the whole being given in not too dry a state. The afternoon feed consists of sound wheat, given at 4 o'clock. The quantities are varied according to the condition of the fowls ; there is, however, no stint of good food.

"Rockdale yards are of loamy sand, and destitute of grass, which is supposed to be so essential in the pens. The birds have rough meadow grass and white clover given them thrice a week. They are also supplied with little boxes containing shell grit, which is necessary to a fowl's digestion."

With the various apparent handicaps and simplicity itself reigning throughout, great results could not be expected. The appended tabulated statement, from the *Daily Telegraph*, shows that all anticipations were at fault, the figures, whether taking individual pens, breeds, or value of eggs, establishing records hitherto unapproached, and all testifying to the confidence the conductor placed in the performance of the fowls from the commencement of the test.

Eggs laid, and net market value of the eggs from each hen.

Owner, Address, and Breed	April.	May.	June.	July.	August.	Sept.	October.	Nov.	Dec.	January.	Feb.	March.	Totals.	Weight per doz. (Oz.)	Market Value.
1. W. J. Loughman, Ulmarra: Black Orpingtons	158	134	96	122	131	149	122	117	125	124	108	75	1461	25¼	128/1
2. H. Flemming, Willoughby: White Leghorns	57	138	114	124	142	135	136	134	133	132	118	80	1443	28¼	121/2
3. J. R. Douglas, Willoughby. Minorcas	91	109	95	110	159	163	145	121	116	98	111	107	1425	25¼	119/7
4. A. J. Creaser, Enfield: Black Orpingtons ..	72	128	143	149	151	136	112	110	103	134	97	69	1404	25¼	121/2
5. J. B. Littlewood, Milton: White Leghorns	54	85	73	105	112	142	166	149	151	144	121	78	1380	26¼	112/1
6. J. Gamble, Ashfield: Black Orpingtons ...	135	101	72	134	139	123	128	102	133	125	105	71	1368	25¼	117/6
7. D. Darragh, Ashfield: White Leghorns	88	122	88	112	143	129	146	128	127	121	90	55	1349	25	112/9
8. H. A. Jones, Thornleigh: Black Orpingtons	131	99	83	117	148	128	111	109	128	110	100	76	1340	25¾	115/3
9. D. W. Albone, Waterloo: Silver Wyandottes	86	112	113	138	136	132	118	103	90	110	104	90	1332	23	114/6
10. G. Woods, Meroo Meadow: Brown Leghorns	34	86	80	107	135	163	153	130	131	133	109	55	1316	23¼	104/6
11. E. J. Winton, Campbelltown: Langshans ...	..	72	145	165	152	156	135	112	101	101	94	78	1311	27½	114/10
12. V. Morrin, Rockdale. Black Hamburgs	30	80	68	97	146	151	151	127	137	133	94	87	1301	25	104/8
13. M. Foran, Chatswood. Black Orpingtons	62	129	118	136	139	148	123	123	116	96	54	35	1279	27	106/-
14. D. B. Kirk, Merrylands: Silver Wyandottes	95	128	79	116	118	120	116	109	100	105	98	89	1273	23	110/3
15. E. T. Griffiths, Waratah · White Leghorns	126	70	59	101	138	139	139	114	99	125	92	67	1269	25¼	105/7
16. C. M. Henning, Rookwood: White Leghorns	76	109	111	120	116	114	121	121	115	90	77	80	1250	25¼	105/9
17. W. O. Hudson, North Ryde. R.C. White Leghorns	84	112	90	110	143	159	167	126	115	70	40	28	1244	23¾	98/2
18. W. Frame, Canterbury. White Leghorns ..	28	71	88	112	133	144	143	138	136	120	82	41	1236	25¼	96/10
19. Mrs. W. J. Dennis, Wagga. Silver Wyandottes	104	73	84	99	112	116	114	102	113	104	87	86	1194	23¾	102/1
20. H. E. Upward, Wyong: White Leghorns	73	121	62	116	134	131	133	130	115	77	45	38	1175	27¼	94/3
21. D. B. Bannister, Pymble: Black Orpingtons	36	81	132	123	124	143	124	88	97	91	78	55	1172	25¼	96/3
22. E. S. O'Sullivan, Beecroft: White Leghorns		35	119	126	133	143	132	124	112	112	87	43	1165	27½	89/11
23. J Campbell, Sans Souci · Silver Wyandottes	30	115	90	123	128	115	112	104	95	93	79	80	1164	24¼	97/7
24. A. Beattie, Blackwall: R.C. Brown Leghorns	23	69	60	90	116	101	120	115	126	130	117	86	1153	19½	93/7
25. A. H. Everingham, Randwick · White Leghorns	67	108	91	92	108	124	122	113	101	103	80	41	1149	25	95/11
26. E. P. Gladwin, Singleton: Silver Wyandottes	10	54	67	122	123	142	140	118	110	100	68	88	1142	23¾	89/2
27. A. B. Gibbes, Fern Hill · Silver Wyandottes	98	83	86	87	113	118	110	93	81	99	72	89	1129	26	97/1
28. G. Payne, Hurstville: Silver Wyandottes	58	119	116	87	126	113	115	107	88	79	57	57	1122	23	95/1
29. R. H. Blamey, jun., Wagga. Black Orpingtons	61	107	72	102	137	119	113	106	101	102	58	41	1119	27¼	92/1
30. E. R. Robinson, St. Mary's Silver Wyandottes	39	104	85	124	122	117	131	100	88	81	62	64	1117	24¼	93/6
31. J. Bell, Croydon · Brown Leghorns	76	40	41	77	125	132	160	138	114	112	84	16	1115	25	85/8
32. J. Ahern, Arncliffe: Black Orpingtons	23	110	99	122	109	127	119	88	85	84	82	60	1108	26¼	91/11
33. Mrs. J. J. Roche, Bay View · White Leghorns	27	88	69	95	118	131	128	118	100	104	89	36	1103	27	87/8
34. Mrs. W. Churchill, Kogarah. Black Orpingtons	19	80	111	85	145	121	122	90	100	101	77	42	1093	23¼	87/11
35. H. Simmonds, Parramatta · Silver Wyandottes	82	98	89	101	108	108	119	79	80	90	70	65	1089	22¼	93/3
36. A. Milne, Ashfield: White Leghorns	76	89	85	116	108	139	124	119	99	61	43	28	1087	26½	88/11
37. C. Eglinton, Burwood: Black Orpingtons	60	114	62	120	85	125	115	98	86	75	73	69	1082	25¼	91/7
38. G. Howarth, St. Mary's: White Leghorns	6	88	70	112	123	128	139	122	110	98	57	28	1081	27¼	85/5
39. G. A. Lowe, Moree. Silver Wyandottes	100	97	102	94	95	112	109	95	93	67	54	59	1077	23¼	93/5
40. G. W. Hanna, Croydon: R.C. Brown Leghorns ..	33	73	58	92	136	131	124	119	116	86	81	25	1074	22½	83/11
41. W. H. Whitmore, Rouse Hill. Silver Wyandottes	60	105	86	94	120	113	98	95	88	78	59	69	1065	23½	90/4
42. T. L. Pyrke, Swamp Oak: Silver Wyandottes	85	100	108	94	110	103	109	102	85	62	55	50	1061	25	91/2
43. F C. Johnson, Beecroft: Silver Wyandottes		41	105	118	117	135	121	108	101	97	61	49	1053	25	81/5
44. G. Pitman, Rozelle: Black Orpingtons		31	64	114	141	141	122	95	104	93	77	61	1043	24	80/3
45. W. Roser, Danglemah: White Leghorns ..	11	68	86	71	111	135	145	134	124	79	50	21	1035	26½	78/11
46. C. Davies, Blayney: Silver Wyandottes	33	79	58	101	104	148	128	96	88	77	54	55	1021	21½	81/2
47. J. A. Booth, Campbelltown · Black Orpingtons	28	89	87	91	114	134	121	96	98	71	45	39	1013	25¼	80/3
48. J. F. Scobie, New Lambton: Silver Wyandottes	38	53	46	104	105	115	103	88	88	60	60	74	934	25	73/2
49. E. W. Lee, Kiama: Black Orpingtons ..	..	24	74	96	134	137	121	101	96	75	50	20	928	25	68/8
50. W. Ireland, Cumnock: Silver Wyandottes		29	106	84	122	116	125	96	67	61	39	45	890	23	67/5

From the above it will be seen that the laying was most extraordinary. Everything in connection with it was most simple. There were no American ideas in the way of scratching sheds, patent drinking vessels, feeding-troughs, &c. No green bone, poultry spice, or other speciality guaranteed to make fowls lay, neither theories nor scientific facts were brought into play, while the chemist with his protein, carbo-hydrates, and other elements which go to make a balanced ration was given the go-by, all showing that the best laying done anywhere has been under the simplest conditions, and the usual recognised poultry foods—pollard, bran, wheat, green stuff, and grit. Maize was eschewed, except about 5 per cent. of that cereal in a meal form.

In an interview with Mr. McIntosh, requesting to what he attributed the extraordinary laying, the reply was, "I always knew hens could do better than they have been doing at these competitions. All they want is ordinary common-sense attention, plain food given at the proper time, and by due observation of

E. J. Winton's Langshans.

each pen to just give the quantity they require, always taking into consideration, of course, the season." "I see," said he, "that the College feed their poultry with exact regularity at 7 a.m. This regularity is not practised at Rockdale, the hour of feeding depending on the season. My fowls always have their food from one to two hours earlier in summer than in mid-winter. I give no ten o'clock or mid-day food, and the quantity supplied depends solely on the eating capacity of the hen."

Coming to the individual pens, the results have emphasised all I have said in "Farmers' Fowls" about laying being a matter of strain rather than breed, and although some breeders who did well in previous competitions have failed in later ones, it is quite capable of explanation. Loughman's Black Orpingtons have made a world's record for this breed. On a recent visit to Grafton I arranged to spend an afternoon at the home of this 243 egg strain, and find out all about them. Ulmarra is situated on the evergreen banks of the beautiful Clarence, Mr. Loughman's yards being

situated a short distance from the river. The fowls have the run of well nigh an acre of lucerne and other pasture. I found nearly 100 well grown cockerels and pullets, typical, but hardly massive enough for present-day show requirements, and are fed on the usual pollard and bran in the morning, wheat in the evening, and occasionally maize. However, what I was most anxious to learn was the strain or stock from which the birds were bred. The following information was supplied, which once more proves that great layers if correctly treated will produce others with like tendencies. Mr. Loughman says:—"My record performers at Rockdale were produced from eggs procured from Mr. H. E. Kelly, of Ashfield, who had sisters to Mr. Ward's, of Gosford, winning pen in the first competition, also eggs Mr. Kelly sent me from Dr. Fiaschi's pen in the first laying-competition. These pullets were mated to a full brother to the leading pen of Black

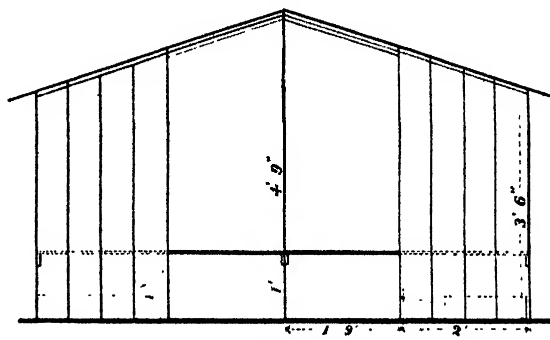
General view of the pens at Rockdale.

Orpingtons in the second competition, which I procured from Mr. Rone, of Riverstone. One of Dr. Fiaschi's pullets I found to be a marvellous layer, and from this bird five out of the six birds comprised the Rockdale pen." It is well known all the names mentioned had good performers at the early tests, and Mr. Loughman with this stock system and care has done what is open to any other breeder, namely, produce a strain of Black Orpingtons, embodying wonderful laying qualities.

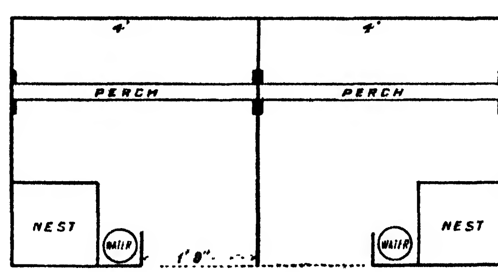
The second pen at Rockdale were White Leghorns, and although I am unable to secure the pedigree of these, there is scarcely a doubt that they have been bred from others that have behaved well in previous tests. At the time of the photographer's visit, the birds were in a sorry condition through moult and a year's hard work. The 1,443 eggs is a record for this or any other breed, Loughman's excepted.

It is notable that all the Leghorns in the Rockdale test averaged 201 eggs each and over.

The third pen—Minorcas—not only look like layers but performed so, and have sustained the reputation of the Mediterranean blacks in a marked degree. This pen of six birds made a record for any breed outside their own competition, and laid 237·5 for each hen. Black Orpingtons secured fourth place with 1,404—another record. Then come Leghorns and Orpingtons again till we get to the eleventh place, which was filled by Langshans. This breed has for some years been under a cloud, but with an average of 200 eggs made at Dookie (Victoria) and 218 at Rockdale, this one time popular fowl should again find favour. However, there is no need to go further with the figures, except to say that it is not the top ones only which have lowered all previous figures in such tests, but the lowest figures as well, which are about 200 higher than in other contests, all of which goes to show that with a flock of pullets from six to nine months of age and gathered from any or all parts of the State, if housed and penned in moderate runs, grassed or otherwise, and simply but intelligently fed with the usual fowls' food, can be depended on to lay fourteen dozen eggs each, which is two dozen less than the average for the 300 hens at Rockdale, and as the average price for eggs for the past few years, one month with another, is about 1s. per dozen, the commercial aspect is apparent.



Elevation.



Ground plan.

The Conductor's Report.

"In reviewing the year's work," reports Mr. McIntosh in *The Daily Telegraph*, "I can only express the hope that the record is as satisfactory to the competitors as it is to myself. The hens have acquitted themselves well, as the fact that only one pen has scored less than 900 eggs shows; and had it not been that the cost of food was exceptionally high throughout, the profit on the year's operations would have been considerably greater.

"The following table compares the average results from the various breeds:—

Breed.	Per Hen, Eggs.	Per Hen, Value.
6 Minorcas ...	237·5	19/11
6 Langshans	218·5	19/2
6 Black Hamburgs	216·83	17/5
6 Rose-combed White Leghorns	207·33	16/4
12 Single-combed Brown Leghorns	202·58	15/10
78 White Leghorns...	201·56	16/4
78 Black Orpingtons	197·56	16/4
12 Rose-combed Brown Leghorns	185·58	14/9
96 Silver Wyandottes	184·01	15/4

Weather Conditions.

"On the whole, the weather was favourable to good results. The winter was, for the most part, warm and dry, and as a consequence the hens laid well when eggs were bringing good prices, and thus early established themselves in the matter of values.

"The most trying period was when fierce, cold southerly winds were frequent, these causing diarrhœa, and invariably checking the laying of the less hardy breeds.

"Some hot spells were experienced in the summer, but although the runs were sandy, artificial sheltering and plenty of mown grass, &c., spread on the white sand, did much to keep the conditions normal, and only two deaths were attributable to the heat.

The Financial Aspect.

"The total cost of feeding was £90 13s., made up as follows:—Wheat, £36 5s.; pollard and bran, £33 11s.; maize meal, £7 15s.; grit, £3 18s.; meat, £6 4s.; green food, £3.

"The monthly laying was:—April, 2,763 eggs; May, 4,450; June, 4,384; July, 5,447; August, 6,257; September, 6,654; October, 6,350; November, 5,550; December, 5,305; January, 4,872; February, 3,844; March, 2,960. Grand total, 58,736 eggs, or 4,894 per month.

"The value of the eggs produced was £241 10s. 9d., from which a sum of £20 15s. 5d. has to be deducted for commission, &c., making the year's return £220 15s. 4d., and the net profit, after deducting the cost of feed, £130 2s. 4d.

The Prize Winners.

"The prize money, amounting to £50, was won as follows, only pens laying eggs averaging at least 23 oz. per dozen being eligible:—

Number of eggs in the twelve months:—

	£	s.	d.		£	s.	d.
1. W. J. Loughman ...	7	0	0	6. J. Gamble	1	10	0
2. H. Fleming ...	5	0	0	7. D. Darragh	1	0	0
3. J. R. Douglas	4	0	0	8. H. A. Jones	0	10	0
4. A. J. Creaser	3	0	0	9. D. W. Albone	0	10	0
5. J. B. Littlewood ...	2	0	0	10. G. Woods	0	10	0

Aggregate market value of eggs:—

	£	s.	d.		£	s.	d.
1. W. J. Loughman ...	2	0	0	4. J. R. Douglas	0	10	0
2. H. Fleming and A. J. Creaser (equal) each ...	1	5	0				

Winter test (first four months):—

	£	s.	d.		£	s.	d.
1. W. J. Loughman ...	3	0	0	4. M. Foran	0	10	0
2. A. J. Creaser	2	0	0	5. J. Gamble	0	10	0
3. D. W. Albone	1	0	0				

Number of eggs last three months (moulting period):—

	£	s.	d.		£	s.	d.
1. J. B. Littlewood, 343 eggs	2	0	0	3. J. R. Douglas, 316 eggs	1	0	0
2. H. Fleming, 330 eggs ...	1	10	0	4. V. Morrin, 314 eggs ...	0	10	0

Number of eggs first month :—

	£ s. d.		£ s. d.
1. W. J. Loughman, 158 eggs	1 10 0	2. J. Gamble, 135 eggs ...	1 0 0

Monthly prize of 10s. (April excepted) for most eggs from a pen :—

May, H. Fleming	138 eggs	October, W. O. Hudson .	167 eggs
June, E. J. Winton ...	145 ,,	November, J. B. Littlewood..	149 ,,
July, E. J. Winton ...	165 ,,	December, J B. Littlewood..	151 ,,
August, J R. Douglas ...	159 ,,	January, J. B. Littlewood ...	144 ,,
September, J R. Douglas and G. Woods (equal) ...	163 ,,	February, J. B. Littlewood ..	121 ,,
		March, J. R. Douglas ...	107 ,,

At the final meeting of the committee of management, Mr. J. Gamble presiding, it was unanimously resolved—" That this committee desires to place on record its high appreciation of the capable and impartial manner in which Mr. McIntosh has conducted the competition, and congratulates him upon the signal success which has attended his judicious management and unremitting attention to the birds entrusted to his care."

The Results.

In the early part of this paper it was mentioned that reference would be made to the results of these competitions, and whether or not they would have the effect of reducing our enormous egg imports, which was the object of the promotion. That they should have this effect is acknowledged, but, so far, it is difficult to determine. One thing is certain—the excellent laying properties of our hens being demonstrated caused many to go into the business; but from several causes there were few stayers, perhaps the chief of these being the fact that, of the several people who made good records at these tests, when orders began to come in to them from this as well as other States, they had little stock to fill the orders, and, to my own knowledge, rather than refuse such, they purchased the birds at the usual auction sales at a few shillings each, and filled their orders at from 10s. to 20s. each with these birds—possibly good enough to look at, but as layers having no reputation. One small breeder, who had little experience of fowls until he purchased, a few years ago, a trio from a well-known fancier, placed six in a competition. They did well, and, by thorough advertising, he received orders for about fifty birds over and above what stock he possessed. The orders were, unfortunately, filled, but, and as might be expected, the aftermath is approaching. The following extract will show the nature of the reflections, and is from the *Canterbury* (New Zealand) *Times*:—

Anyone contemplating sending to Sydney for birds or eggs would be wise in finding out the experience Mr. G Rollinston, of Kaiapoi, has paid dearly for. Two sittings from one big advertiser produced five cross-breds; another sitting, from a competition breeder of Silver Wyandottes, gave one chick—a cross between a Golden-spangled Hamburg and something else—and he has two Buff Orpington chicks and a cross-bred from another sitting of Silver Wyandottes. From his two 260 tested hens (Black Orpingtons) for laying, one died after laying twelve eggs in three months, and the other has produced twenty-six eggs in six months, and weighing only 1½ oz. each. Our correspondent has also seen the New South Wales stock at Mr. Rollinston's yards; and I am sure the utility breeders of Sydney are doing themselves harm in sending rubbish to New Zealand.

Another thing that has done a good deal of harm is that some breeders, whose stock made good records but was not presentable to the eye, purchased show-birds from other breeders, and in some instances imported from England, with the almost certain result that the crossing of these with their own had a most detrimental effect on the egg-production of their own strain. These better-looking birds were sold, many of them doing badly.

Breeders who have good laying strains should be most careful before introducing strange blood. If better-looking stock be desired, they should go to someone who has the same strain, and make a selection. Some of the best performers in the early tests, who are doing badly of late, have themselves to blame in this respect. The point now is, have the laying-competitions in this State increased our egg supply? In some quarters it is said so; but all the records of the statists and Customs show otherwise; at least, they conclusively prove that our egg imports are not only increasing, but alarmingly so. The Federal tariff of sixpence per dozen soon stopped the Chinese eggs; but from an article in last month's *Gazette*, by Mr. Jackson, it will be seen that, rather than decreased imports, due to a larger local production, the figures show the reverse.

The following affords food for reflection, and certainly requires a lot of explaining by those who still think that the local production is on the increase.

EGG IMPORTS.

Whence—	1903.		1904.		1905.	
	doz.	£	doz.	£	doz.	£
Victoria	17,248	832	22,718	761	42.606	1,128
Queensland	66,571	2,964	216,363	5,912	293,364	7,117
South Australia	726,225	34,014	1,016,218	35,077	1,101,478	29,108
West Australia	.....	......	....	.. ..	....	... ..
Tasmania	982	41	280	9	10	12
New Zealand...	......	... ..	.. .. .	.. ...	28	3
United Kingdom ..	10	2	78	13	4,176	131
Canada	.. ...	....	....	. ...	. ...	... ..
Natal	......	.....	.. ....	.. ...	... .	......
China	111,557	1,524	65,005	847	1,056	21
Hongkong	......	.. ...	81,890	1,104	1,754	30
Germany	......	.. ..	28	1	6,511	182
Japan	......	......	... . ..	......	1,224	20
New Hebrides .. .	.....	.....	... .	......	. ...	....
United States	2,010	93	240	100	....	.. ...
Totals . ..	924,603	39,470	1,402,820	43,824	1,452,207	37,752

It will be seen that the egg imports have increased the past three years by about half a million dozens, and amounts in value to over thirty-seven thousand pounds, the slight reduction in total value being due to the lower price of the eggs.

The Poultry Industry.

H. V. JACKSON,
Export and Cold Storage Branch.

In the April issue of the *Agricultural Gazette*, some particulars were given of the exports and imports of live poultry, frozen poultry, and eggs. This information proved to be of very great interest to those engaged in the export of such products, as also to the farmers, who are now giving more attention than formerly to the proper care and intelligent management of the common fowl. The following return, kindly supplied by the Acting Collector of Customs, now shows the quantity and value of live poultry, frozen poultry, and eggs shipped to other States of the Commonwealth during the years 1903, 1904, and 1905:—

LIVE POULTRY.

To—	1903.		1904.		1905.	
	No.	£	No.	£	No.	£
Victoria	51	6	4	18	507	114
Queensland	9,423	958	2,108	1,262	1,139	566
South Australia	50	32	140	91	231	135
West Australia	506	131	2,320	290	1,136	284
Tasmania	346	109	152	66	197	142
Total	10,376	1,236	4,724	1,727	3,210	1,241

FROZEN POULTRY.

To	1903.		1904.		1905.	
	lb.	£	lb.	£	lb.	£
Victoria	44	7	48,450	614	1,065	24
Queensland	......	......	96	6	..	...
South Australia	....	.....	......	......	....	......
West Australia	....	.....	2,953	121	14,205	469
Tasmania	.	....	.....	......	....	......
Total	44	7	51,499	741	15,270	493

EGGS.

To—	1903.		1904.		1905.	
	Doz.	£	Doz.	£	Doz.	£
Victoria	49,784	2,210	51,900	2,056	60,647	1,879
Queensland	1,544	66	1,100	93	344	77
South Australia	2,677	149	276	45	28	10
West Australia	......	......	5,939	235	24	2
Tasmania	88	4	2,339	98	1,176	73
Total	54,093	2,429	61,554	2,527	62,219	2,041

Our best customer for live poultry in 1903, 1904, and 1905, apparently, was Queensland, the figures being £958, £1,262, and £566, West Australia coming next. In frozen poultry, West Australia appears to have been our best customer; but the value of the quantity sent to that State in 1905 was only £469. The State of Victoria has been our largest customer for eggs, the value in 1903 being £2,210, £2,056 in 1904, and falling away to £1,879 in 1905.

The totals of exports to the States of the Commonwealth have been as follows:—

	Live Poultry.	Frozen Poultry.	Eggs.
	£	£	£
1903	1,236	7	2,429
1904...	1,727	741	2,527
1905...	1,241	493	2,041

The total export of poultry and eggs from New South Wales to the other States of the Commonwealth has, therefore, been as follows:—

1903, £3,672; 1904, £4,995; and 1905, £3,775 worth.

The exports of these products are, therefore, seen to be exceedingly small in comparison with the large values of imports for such products from our neighbours.

Forestry.

Some Practical Notes on Forestry suitable for New South Wales.

[Continued from page 469.]

J. H. MAIDEN,
Government Botanist and Director of the Botanic Gardens, Sydney.

XIV.

Division of New South Wales into Plant Regions.

It will appeal to everyone that a map of New South Wales, indicating the various regions in which the conditions of plant-life are approximately uniform, is a very desirable thing. It is an absolute necessity to the forester for example.

The practical value of a plant-map will be immediately seen by persons who desire to cultivate plants which are new to their districts. My experience goes to show that many people have the desire to cultivate plants provided they know what to cultivate, and that many are hindered at the threshold because of uncertainty. I hope my map, which I will submit, will also be useful to nurserymen and others engaged in the distribution of plants. Such work cannot always be, as regards every detail, in the hands of the principals of a firm, who may perhaps have travelled all over the State and know local circumstances and requirements.

In an early paper I propose to begin a list of desirable exotic plants for New South Wales, and to roughly indicate the areas in which they will most probably succeed with reference to the map which will be referred to presently. But when one begins to construct such a map —"aye, there's the rub!"—New South Wales presents considerable diversity in regard to her topography, soil, and climate; but when it comes to assess these differences pictorially or by figures, experience shows that the exceptions are so numerous that a "plant-map" must be read philosophically, and used only as a general guide.

In the present series of articles, *before* submitting a list of exotic plants (forest trees, and smaller plants of horticultural interest) grown in New South Wales, it seems to me desirable to prepare such a map as I have indicated. I intend to endeavour to improve it from time to time. Such a map must, I think, be primarily based upon the plant regions of our indigenous vegetation. I therefore make no apology for introducing here the Botanical Map of New South Wales, which accompanied my Presidential Address, before the Linnean Society of New South Wales for the year 1901 (Proceedings 1902, p. 759).

I have defined and provisionally named each "county" and the description of each county (or that of most of them) is followed, in smaller type, by a list of readily accessible botanical papers (some of them chatty and far from

technical) which give detailed information in regard to the vegetation of the various areas, and which cultivators of various kinds would do well to peruse. In other words, I submit my map of 1901-2 as a basis for plant-maps.

A. EASTERN COUNTIES.

E 1. MONARO COUNTY.

This consists of the well-known table-land of the Monaro, and is bounded on the east by the Dividing Range, on the south by the Victorian border, on the west by the Snowy Range (Mt. Kosciusko to Kiandra), and on the north by the Micelago Creek. It comprises the counties of Wallace, Wellesley, and Beresford.

Botanical Records arranged Topographically.

I submit a number of readily accessible papers arranged for the purposes of a botanical survey. I do not suggest that the list is exhaustive; one of our young botanists might readily make it so. Publications of this character might suitably be published in a separate series, after the fashion of the "Records of the Botanical Survey of India."

Botanical Records.—Maiden, J. H.—A list of Plants collected by Mr. Richard Helms in the Australian Alps, February, 1893. *Agric. Gazette*, N.S.W., v, 836.
—— The Flora of Mt. Kosciusko. *Ib.* ix, 720.
—— A second Contribution towards a Flora of Mt. Kosciusko. *Ib.* x, 1,001.

E 2. SOUTH COAST COUNTY.

While this district is commonly known as the "South Coast," the term "South Coast Range" should perhaps be added to it. It comprises the counties of Auckland, Dampier, St. Vincent, and Camden (exclusive of Illawarra and of that portion west and north-west of the railway line between Marulan and Mittagong).

Botanical Records.—Maiden, J. H.—Notes on the Geographical Distribution of some New South Wales Plants, S. Coast. *Proc. Linn. Soc. N. S. W.*, (2), iv, 107.

E 3. ILLAWARRA COUNTY.

For botanical purposes I would define the boundaries as—east, the ocean; west, the Illawarra Range; north, the Cordeaux River; and south, the Coast Range.

As thus defined, the Illawarra is a fairly definite botanical area. The South Coast and North Coast counties include many portions of brush country very similar to that of the Illawarra. Different people, however, define the Illawarra differently.

McFarland, in his "Illawarra and Monaro" (Sydney, 1872), defines the Illawarra as extending from Bulli to the Shoalhaven, and lying between the Pacific and the Coast Range; it is about 55 miles in length as the crow flies, and its width is from half a mile to 10 miles. He has a foot-note—"The lands that lie to the south of the Shoalhaven River are sometimes included under the term 'Illawarra'; but they are different in scenery, soil, and principal products from those on the north."

E 4. Cumberland County.

This is the political county of the name, and includes the country in the neighbourhood of the capital (Sydney). It is practical and convenient to the majority of New South Wales botanists to retain this as a botanical division.

Botanical Records.—Woolls, W.—Plants indigenous and naturalised in the neighbourhood of Sydney. Government Printer, Sydney. 1st ed., 1880; 2nd ed., 1891.
—— Eucalypts of the County of Cumberland. *Proc. Linn. Soc. N.S.W.*, v, 288, 448, 463, 488, 503.
—— Botany of the Parramatta District; Woods of the Parramatta District. *Contrib. to Flora of Australia* (1867), pp. 1, 89.
—— List of Parramatta Ferns, etc. *Lectures on the Vegetable Kingdom*, 1879, p. 214.

E 5. Blue Mountains County.

This comprises the county of Cook, and is a well-defined area of sandstone mountains, including a few isolated volcanic mountain tops. The sandstone is chiefly Hawkesbury Sandstone.

Botanical Records.—Cunningham, A.—On the Botany of the Blue Mountains. Barron Field's *Memoirs on N.S.W.* (1825), p. 323.
Woolls, W.—Kurrajong and Tomah. *Contrib. to Flora of Australia* (1867), p. 173.
Trebeck, P. N.—Mt. Wilson and its Ferns. *Proc. Linn. Soc. N.S.W.* (2) i, 491.
Woolls, W.—A glance at the Flora of Mt. Wilson. *Proc. Linn. Soc. N.S.W.* (2), ii, 6.
Hamilton, A. G.—On the Flora of Mt. Wilson. *Proc. Linn. Soc. N S.W.*, xxv, 346.
Maiden, J. H., and Cambage, R. H.—Notes on the Eucalypts of the Blue Mountains. *Proc. Linn. Soc. N.S.W.*, xxx, 190.

E 6. Hunter Valley County.

It comprises the counties of Northumberland, Durham, and Brisbane (east of Great Northern railway.)

It is largely sandstone, and of comparatively low altitude. The sandstone is chiefly carboniferous, though that in the southern part is Permo-Carboniferous. To the north it is rather dry.

Botanical Records.—Woolls, W.—Botany of Ash Island. *Contrib. to Flora of Australia* (1867), p. 184.
Barwick, A. C.—The Botany of the "Clears" and "Basalt Masses." *Proc. Linn. Soc. N.S.W.*, xxviii, 932.

E 7. North Coast County.

It comprises the counties of Gloucester, Macquarie, Dudley, Raleigh, Fitzroy, Clarence, Richmond, and Rous (between the Richmond River and the Coast).

Botanical Records.—Rudder, A.—Forest Wealth of Gloucester. *Agric. Gazette N.S.W.*, vi, 383.
Maiden, J. H.—Notes on a Trip to the North Central Coast Forests of New South Wales. *Agric. Gazette N.S.W.*, vi, 583.
—— Mount Seaview and the way thither. *Agric. Gazette N.S.W.*, ix, 577.
—— Notes on a Trip to Mount Seaview, Upper Hastings River. *Proc. Linn. Soc. N.S.W.*, xxiii, 20.
—— The Don Dorrigo Forest Reserve. *Agric. Gazette N.S.W.*, 1894, pp. 218, 519.

E 8. Upper Richmond and Clarence County.

It consists mainly of elevated plains and slopes, and is grazing country for the most part. It is intermediate in character between New England and the coast. It comprises the counties of Gresham (eastern half), Drake, Buller, and Rous (west of Richmond River). This county is partly inclusive of the Upper Richmond River district as defined in W. S. Campbell's paper in *Agric. Gazette*, p. 416 (1899), with map.

E 9. New England County.

This consists of the following counties :—Arrawatta (eastern half), Clive, Gough, Gresham (western half), Clarke, Hardinge, Sandon, Inglis (eastern half), Vernon, and Hawes.

Its boundaries are :—North, the Queensland border; east, the steep escarpment; south, the Liverpool Range; and west, the Liverpool Plains.

It has an average elevation of, say, 2,500 to 3,000 feet.

Different authorities vary in their definitions of New England. Mr. T. W. Connolly, the District Surveyor of Armidale, has kindly favoured me with the following note on the subject :—

"This district should be strictly regarded as being identical with the old pastoral district of that name, but the name has been adopted for a mining district, which does not quite coincide with the pastoral district.

"Locally it has a more restricted meaning, and attempt is made to apply it solely to the high lands. The escarpment on the east is not easily defined, as it follows gullies breaking into and forming precipitous falls so irregular that definition would be a laborious task."

Botanical Records.—Christie, W.—The Forest Vegetation of Central and Northern New England in connection with Geological Influences. *Journ. Roy Soc. N.S.W.*, xi, 21.

Maiden, J. H.—Notes on some Eucalypts of the New England Table-land. *Report A. A. A. S.* vii (Sydney), 537.

Turner, F.—The Flora of New England, N.S.W. (Abstract). *Report A. A. A. S.* viii, (Melb.), 275.

—— The Vegetation of New England, N.S.W. *Proc. Linn. Soc. N.S.W.*, xxviii, 276.

Cambage, R. H.—Notes on the Native Flora of New South Wales.
Part 2. Western Slopes of New England. *Proc. Linn.. Soc. N.S.W.*, xxix, 781.
See C. 3. Mr. Cambage's Journey was from Moree to Inverell.

E 10. Liverpool Range County.

This connects the Hunter River county with the western country.

It comprises the counties of Bligh, Brisbane (eastern portion), Hunter, and Phillip. It is one of the intermediate, or "stepping-stone" counties.

Botanical Records.—Baker, R. T.—Botany of Rylstone and the Goulburn River District. *Proc. Linn. Soc N.S.W.*, 1896, 427.

Baker, R. T.—A Revision of the Eucalypts of the Rylstone District. *Ib.* xxviii, 349.

Hamilton, A. G.—A List of the Indigenous Plants of the Mudgee District. *Proc. Linn. Soc. N.S.W.* (2), ii. 259.

Cunningham, A.—See also E 11.

E 11. Southern Table-land County.

Average elevation, say 2,200 feet, and consequently somewhat lower than the northern table-land (New England). An indefinite or intermediate county shading on the west into the plains country, and on the east into the coast country. The Great Dividing Range runs through it in a south to a north direction. Northern boundary, Cudgegong River; eastern, Blue Mountains and South Coast counties; south, Monaro; west, western boundary of Selwyn; thence northerly along the Central-Eastern Land Division boundary to Gundagai; thence along the Murrumbidgee to Yass; thence along the Boorowa River to Cowra, and northerly to Orange; thence along the north-eastern boundary of Ashburnham; and thence along the Bell River to Wellington.

Botanical Records.—Woolls, W.—Botany of Berrima and Mittagong. *Contrib. to Flora of Australia* (1867), p. 101.

Maiden, J. H.—Concerning Hill Top. *Agric. Gazette N.S.W.*, vii, 263.

—— A List of Plants Collected in the Vicinity of the Jenolan Caves, by W. F. Blakely and J. C. Wiburd. *Agric. Gazette N.S.W.*, xii, 1390.

Ross, W. J. C.—Notes on the Flora of Bathurst and its Connection with the Geology of the District. *Report A. A. A. S.*, vii (Sydney), 467.

Cambage, R. H. See also C 1.

Notes on the Native Flora of New South Wales. Part 1. The Tumberumba and Tumut Districts. *Proc. Linn. Soc. N.S.W.*, xxix, 685.

Cunningham, A.—Journal of a Route from Bathurst to Liverpool Plains. *Barron Field's Memoirs on N.S.W.* (1825), p. 131, (*includes* E. 10 *and* C 2).

CENTRAL COUNTIES.

C 1. Wagga–Forbes–Dubbo County.

This is another of the intermediate counties. It connects the table-land with the western plains.

Its boundaries are :—East, southern table-land and Liverpool Range county ; north, Liverpool Plains ; west, conventional lines joining Coonamble to Dubbo, Dubbo to Narrandera, and Narrandera to Corowa (a more correct boundary would be a somewhat sinuous line between Narrandera, Forbes, and Dubbo) ; south, Murray River.

Botanical Records.—Woolls, W.—The Botany of the Castlereagh District. *Lectures on Vegetable Kingdom* (1879), p. 61.

Cambage R. H.—Notes on the Botany of the Interior of New South Wales. Part vi. From Marsden to Narrandera. *Proc. Linn. Soc. N.S.W.*, xxvii, 186. [Marsden is just inside my W2.] Do. Part vii. From Forbes to Bathurst, *loc. cit.* p. 561. Much of this country is in E 11].

—— Notes on the Native Flora of New South Wales. Part iii. Orange to Dubbo and Gilgandra. *Proc. Linn. Soc. N.S.W.*, xxx, 203.

C 2. Liverpool Plains County.

I would define it as including the counties of Darling, Nandewar, Jamison (eastern half), Baradine (eastern half), White, Pottinger, Buckland, Parry, and the western half of Inglis. Bounded on the east by New England ; on the west it tapers off into the sterile sandy country, and is bounded by a conventional line from Coonamble to Bogabilla ; on the south by the Liverpool Range. Mean elevation, say 900 feet.

Cunningham, A. See E 11.

C 3. Macintyre Gwydir County.

It includes the upper waters of the Macintyre and Gwydir.

It slopes from New England to the west, where it joins the sandy or sterile plains, being bounded by the conventional line from Coonamble to Bogabilla. It is a county corresponding in some respects (though drier) to the Upper Richmond-Clarence county on the east. The floras of C 3 and E 8 are somewhat different. C 3 tones off into W 4, while E 8 tones off into E 7.

Cambage, R. H. See E 9.

WESTERN COUNTIES.

Western Plains.

The western plains comprise the greater portion of New South Wales, extending from north to south. There is considerable uniformity in the

flora; but, chiefly because of its vast area, I have endeavoured to break it up, mainly on geological lines. The Murray-Murrumbidgee county is submitted as a fairly well defined botanical area, and the three other divisions are given with the view of ascertaining if they are a guide to the flora upon them. Certainly, as one crosses the Darling from the direction of Bourke, the vegetation is different, and we encounter sand-ridges and salt lakes; but these are not confined to the cretaceous, nor, indeed, to the trans-Darling country, as they are to be found east of the Darling in the Cainozoic country.

It seems desirable that such an unwieldy area should be broken down into convenient portions, if possible, and, if study of the areas I have suggested shows that they have no practical utility for botanical purposes, it may result in better divisions being indicated.

W 1. Murray Red Gum County.

This consists of the country enclosed between the rivers Murray and Murrumbidgee, and is bounded on the east by a conventional line joining Corowa and Narrandera. It includes the area liable to be flooded, comprising the valuable Murray Red Gum (*Euc. rostrata*) flats. Much country similar in character occurs between the Murray and the Murrumbidgee It has better soil than the other three western counties, and has much less mallee scrub.

Botanical Records.—Turner, F.—The Botany of South-western New South Wales. *Proc. Linn. Soc. N.S.W.*, xxix, 132.
[The country is 33° S. lat. and the Murray River, and long. 141°–147° east.]
This includes W 1 and part of W 2.

W 2. Cainozoic County.

So called because the area is mainly Cainozoic, according to the geological map of New South Wales Geological Survey.

The proposed boundaries are: —On the west, South Australia; north, 31st parallel to the Darling River at Myall in the east; thence south-easterly in a conventional line between the Myall and Condobolin, and intersecting the conventional line between Narrandera-Dubbo line referred to; south, the rivers Murrumbidgee and Murray.

In the "key" of the N.S.W. Geological Map, the Cainozoic area is defined as "chiefly Pleistocene, with areas of red clay, rounded quartz pebble-drift of probably Pliocene age, and deposits of black flood-loam of recent origin."

Botanical Records.—Woolls, W.—Plants of the Darling (lower). *Contrib. to Flora of Australia* (1867) p 192.
Deane, H.—List of Plants collected at Broken Hill and Tarrawingee, N.S.W. *Proc. Linn. Soc. N.S.W.* (2), viii, 329.
Cambage, R. H. See C 1.
Turner, F. See W 1.

W 3.—West Silurian County.

This consists of the Western Plains, in which Silurian rocks predominate. See the geological map already quoted.

Bounded by the Cretaceous and Cainozoic Counties, and south east by a conventional line that joins Narrandera and Dubbo.

Botanical Records.—Cambage, R. H.—Notes on the Botany of the Interior of New South Wales :—

1. From the Darling River at Bourke to Cobar. *Proc. Linn. Soc. N.S.W.*, xxv, 591.
2. From Cobar to the Bogan River above Nyngan. *Ibid.*, p. 708.
3. Mudall on the Bogan to Euabalong on the Lachlan. *Ibid.*, xxvi, 197.
4. Mount Hope to Parkes. *Ibid.*, 317.

Turner, F.—Botany of the Darling, N.S.W. *Proc. Linn. Soc. N.S.W.*, xxviii, 406.
[This paper touches upon W 2 and W 4 also.]

W 4.—Cretaceous County.

It consists of Lower Cretaceous areas, with a few patches of Upper Cretaceous or Desert Sandstone. See the geological map already referred to.

The boundaries are Queensland on the north, and South Australia on the west; and on the south parallel 31°, and the Darling and Macquarie Rivers; on the east, a conventional line from Dubbo north to Coonamble, and thence north-west to Bogabilla.

This subdivision, if tested, will, at least, prove if the Cretaceous has any special flora.

Botanical Records.—Turner, F.—Botany of North-western New South Wales. *Proc. Linn. Soc. N.S.W.*, xxx, 32.
[This is the most suitable county to which I can fit this paper.]

B. Then allow me to draw attention to a coarser division of the forest areas of New South Wales, which will be found in a previous article,* which is also accompanied by a map. It may be found suggestive.

C. We all know that the old land divisions—Eastern Division, Central Division, Western Division—are of practical use. But when it is pointed out that the western boundary of the Eastern Division begins at Albury, and passes near Gundagai, Grenfell, Forbes, Dubbo, and Wellington, Gunnedah, Inverell, &c., including the coastal strips, the high table-lands, and part of the western slopes, it will be at once seen that it includes too great a range of climate and soil for our present purpose.

D. A valuable map, indicative of the isothermal lines, showing mean shade temperature, is issued by the Sydney Observatory, and is most valuable for reference by constructors of plant-maps.

E. The rainfall maps, also issued by the Observatory, are invaluable for reference, but of less value in constructing a plant-map such as we have in view.

F. At the same time, the skeleton rain map used by the Observatory is a very useful document for our purpose. The latest edition (1905) of this map makes the following classification of the area of this State :—

South Coast.	South-western Slope.
Metropolitan.	Central do do
Hunter and Manning.	North do do
North Coast.	North-western Plain.
Northern Table-land.	Central do do
Central do	Riverina.
Southern do	Western Division.

* "The Forests of New South Wales," by J. H. Maiden. *Agric. Gazette*, N.S.W., July, 1901.

G. The fine geological map of New South Wales, published by our Geological Survey, has been carefully studied by me, in the hope that it might be materially incorporated in a "plant-map," but I have been disappointed, since the geological formations are so split up, and, with important exceptions, do not lend themselves to grouping in extensive contiguous surface areas.

At the same time, a student of our vegetation is compelled to study the geological map when it comes to studying local plant and cultivation problems.

Recently the Geological Survey has published a geological sketch map of the country in the vicinity of Sydney. This is the forerunner of local sketch maps, and it seems to me that an intelligent farmer or forester cannot afford to be without the clearly indicated information as to geological formations it displays. We have much to learn in regard to the affinity (or the reverse) of plants for certain geological formations, and the sooner we settle down to elucidate such information for New South Wales the better it will be for pastoralists and cultivators of all kinds.

I now submit my proposals which, in view of the inevitable improvement, and consequent alteration, of the map as fresh data are available, may be known as Maiden's Plant-map of 1906, or Vegetation Zones Map.

1. Monaro.

This is our bleakest region, next to that of the Snowy Mountains. It is windswept from the Antarctic and the Snowy Range (*e.g.*, Mt. Kosciusko and the Kiandra country).

a. The Monaro.

b. The Snowy Mountains.

c. The Northern and Southern Table-lands are the areas in which English forest-trees and fruit-trees flourish best.

1a. *Snowy Mountain region* (a subsection of the Monaro). This is the coldest or alpine region of New South Wales. Its mean temperature is 46° and 47°, and I have taken the area from the isothermal map. Many plants of Northern Europe are hardy here, and, conversely, the plants of this region are, many of them, hardy in Britain.

In the map, the Snowy Mountain Region is shown carved out of the Monaro, as defined in my Linnæan Society of N.S.W.'s map.

[There is another cold area, viz., the Canoblas region (Orange), which forms a distinct area, 55° of average temperature, on the isothermal map; but owing to the smallness of the area with a greater elevation than 3,500 feet around the Canoblas, and considering the fact that it is unprotected from the hot north-west winds, I scarcely think it would be satisfactory to include this area with the Monaro. I fancy there are other spots as large, as for instance around Sunny Corner, with equal or even better claims to inclusion.]

2. South Coast.

Edge of the Table-land to the coast (includes the Illawarra and county of Cumberland).

This is a region which is kept at an equable temperature by the Pacific Ocean on the east, and is largely protected from cold southerly and westerly winds by the Dividing Range (or Table-land) on the west and south. The conditions are much the same as those of the "North Coast," though the average temperature is of course less. The coastal strips are warm and usually well supplied with rain. They are, with the exception of the littoral sandy strips, usually fertile areas.

3. North Coast.

From the Hawkesbury River, northward to the Queensland border and extending westerly to the edge of the Table-land or to an elevation of, say, 2,000 feet.

See "South Coast." Plants just too tender for the South Coast may be expected to flourish on the North Coast.

3a. *Northern Rivers.*—I would make, as a subsection, the rich alluvial land from (say) the Clarence to the Tweed. The soil is good, often rich, the rainfall very good, the average temperature high (68°), and the area is suited for sub tropical cultivation.

2b, 3b. *Ocean beach or "strand,"* usually sandy, but always wind-swept with salt-laden breezes.

May be looked upon as a subsection of South Coast or North Coast, as the case may be.

A special class of plants is required for this strip, many of them being required simply for shelter.

4. Northern and Southern Table-land

(includes New England, the Blue Mountain Region, and the Southern mountain country as far as the Monaro). Mean elevation, 2,000–3,000 feet. It includes slopes to the east and west.

[The Orange district, including the Canoblas, with a mean temperature of 55 degrees, has already been referred to.]

New England, with a mean elevation of about 3,000 feet, is the coldest portion of the Table-land, being only a little less bleak than the Monaro. For many practical purposes, the conditions of plant-life in New England and the Monaro may be looked upon as identical.

The rest of the Northern and Southern Table-lands will, however, enable tenderer plants to flourish.

5. Western Slopes.

This is a country which connects the Table-lands with the Western Plains Its boundary is, therefore, more or less indefinite. I have given its western boundary as the Riverina (to be referred to presently) lines from Condobolin to Dubbo, Dubbo to Coonamble, Coonamble to Boggabilla, respectively, obviously lines more or less arbitrary.

The eastern boundary is, roughly, a line northerly from the Murray to Adelong and Gundagai; thence to Yass, Orange, Molong, Wellington; thence easterly along the Cudgegong and Goulburn Rivers to Muswellbrook; thence northerly through Scone, Murrurundi, Tamworth, Inverell to the Queensland border.

Except for the north, this line is a scientific one, in that it is the western "curving boundary" of the White Box (*Eucalyptus hemiphloia*, variety *albens*).

5a. *Riverina* (as a subsection of the preceding).

The boundaries may be defined as the course of the Murray from Corowa to its junction with the Lachlan; thence up the Lachlan to Condobolin; thence arbitrary lines from Condobolin to Lake Cowal, Lake Cowal to Narrandera, and Narrandera back to Corowa.

6. Western Plains.

I include in this all country west of Riverina and the Western Slopes.

This is the nearest approach to a desert in New South Wales. With its vast area, the conditions obviously vary. The chief drawback is the low and uncertain rainfall. It is the most difficult portion of New South Wales in which to acclimatise plants.

From what has been said, if it be decided to institute an even simpler classification, the following may be adopted:—

A. *Cold Region*, where British trees flourish.

[Includes 1, 1a, 4 of the above classification.]

B. *Coastal strip*.

[Includes 2, 3, 2b, 3b of the above classification.]

C. *Northern Rivers*.

[A distinctly sub-tropical belt, forming the north-eastern portion of the State, 3a in the above classification.]

D. *Western Slopes and Riverina*.

[5 and 5a of the above classification. The country is intermediate between the well-watered eastern portion and the western "almost desert."]

E. *Western Plains*.

[6 of the above classification.]

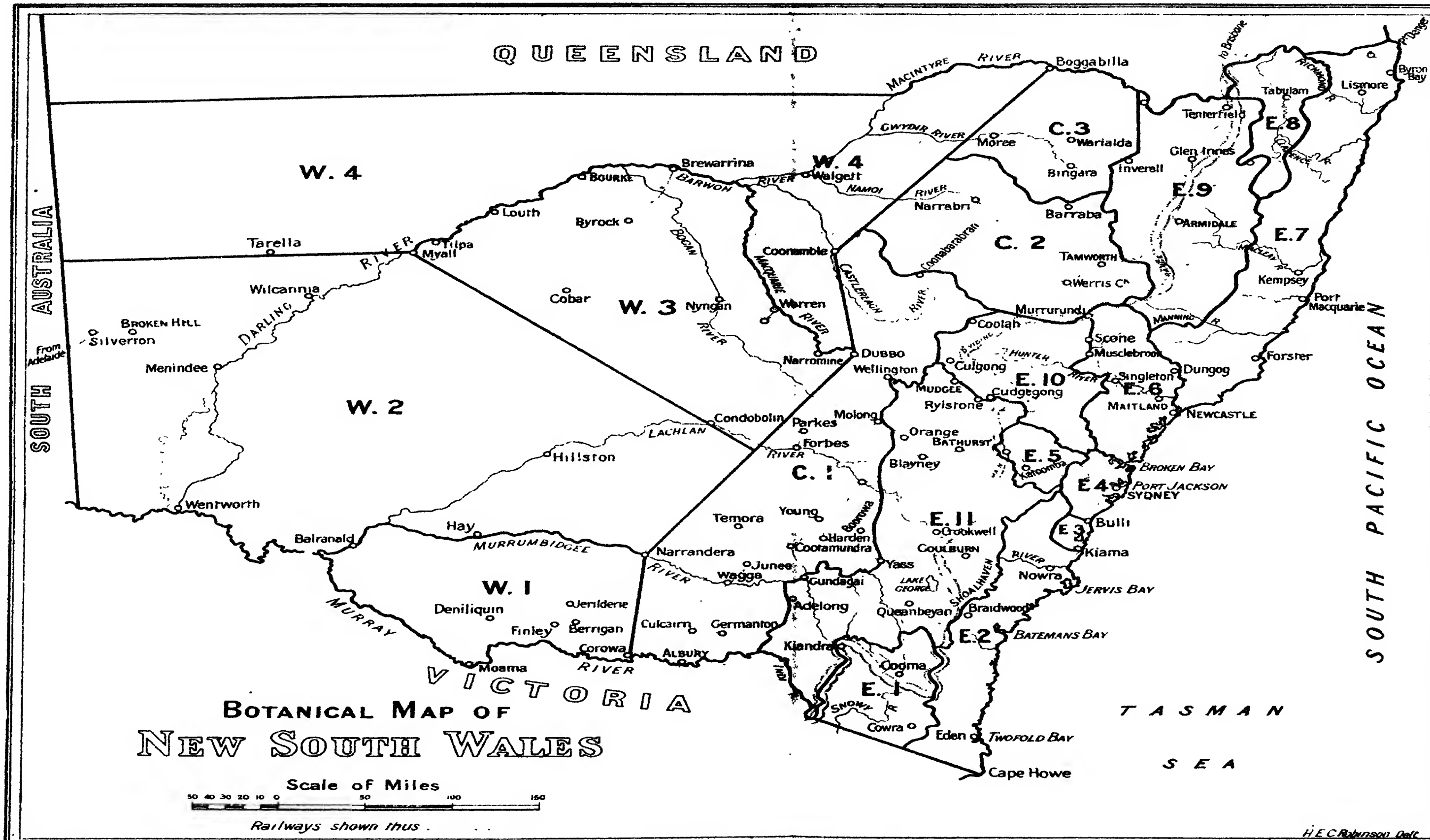
(*To be continued.*)

Are Salt-bush Seeds injurious to Wool?

The Director of the Botanic Gardens at Durban, Natal, sends me a piece of mohair, with seeds (fruits) of the Australian salt-bush (*Atriplex holocarpa*, F.v.M.) adherent thereto. He asks if salt-bush seeds are a nuisance to wool-growers. I have replied that salt-bush seeds are very abundantly produced, and that I have often seen them matted on wool, but that I have never heard of them being a nuisance, like the hooked seeds of the Medicks (*Medicago*) or of Bathurst Burr (*Xanthium*), since they can be very readily removed from the fleece, and, indeed, largely drop out in the process of handling in the shearing-shed. Have readers of the *Gazette* any information on the subject?—J. H. Maiden, Government Botanist.

DIAGRAM MAP OF
NEW SOUTH WALES
SHOWING
VEGETATION ZONES (1906).

46679



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Report from the Agent-General.

Frozen Pork.

THE Minister for Mines and Agriculture has received a report from Mr. Coghlan, Agent-General in London, wherein he says, it having been brought under his notice that, out of several consignments of frozen pigs which have come to hand from Australia during the last few months, a somewhat unduo proportion have been condemned at Smithfield, he instructed Mr. Clarke to call and obtain the views of the Chief Inspector of Health, Metropolitan Meat Markets, Smithfield, upon the matter.

Mr. Terrett, the Inspector, reported as follows; and as his views may be of value to our exporters, Mr. Coghlan quotes his statement:—

"Australian pigs, including, however, only a few from New South Wales, have been condemned at Smithfield recently on several separate grounds.

"In some instances there have been particles of the lung adhering to the pleura, and in such cases the Inspector has discretionary power to condemn. In the absence of the lungs, the Inspector does not condemn the carcase as necessarily tubercular; but the particles of the lung adhering to the pleura create a suspicion, and this fault in butchering is one that will not be permitted in carcases exposed for sale, even if they did pass through Smithfield.

"Then sometimes the pork, as the result, apparently, of improper feeding—probably excessive maize-feeding—has a 'wet fishiness of appearance' when thawed out that renders the carcase repulsive; and carcases of pigs of this character, although they may have been passed in the first instance, must ultimately be condemned, because butchers will not buy them, and they go bad on the hooks awaiting sale. For many years American pork carcases were condemned for this special defect.

"So far as actual disease in New South Wales pigs is concerned, the Chief Inspector states that there is little to complain of. He and his staff subject every carcase to most vigorous examination; and beyond the cases of pleural adhesion, which, while being a fault subject to condemnation, he does not, in the absence of the lungs, assert is in every case conclusive evidence of pulmonary disease, the actual cases of tuberculosis are a negligible quantity.

"The great trouble is due, as it used to be in the case of American pork, not to want of care on the part of those responsible for preventing the inclusion of diseased carcases, but to the want of care in the selection of carcases. Any defects, such as softness of fat, which detract ever so slightly from the appearance of the unfrozen carcase, are greatly emphasised in the process of freezing, storage, and thawing out; and such carcases inevitably run the risk of being condemned.

"Thin pigs should on no account be slaughtered for oversea trade. They thaw wet, which gives them the appearance, when thawed, of a dropsical pig. In such cases, the Inspector is practically certain to go to the extreme of condemning the carcases, because the people who expose these carcases for sale are liable to prosecution.

"Prolonged storage and handling is one of the worst evils to which the Australian frozen pork could be subjected. There is a deterioration which sets in from the beginning, and the less time pork can be kept in store the better. It would be for the benefit of the trade, from both the exporters and the wholesale and retail sellers' point of view, if it were the law that all meat should be sold within a month of landing here. Long storage and handling produces flavours which create distaste for oversea produce."

The Chief Inspector expresses the opinion that the New South Wales pigs comprised a large proportion of carcases to which no objection could be taken; and he thinks that if those responsible for exportation will take care to send none but firm, well-nourished carcases, properly butchered, the trade should expand.

Mr. Terrett is a man with a life-long experience in the meat-markets, and I feel sure his views will be welcomed by our producers, even though contrary opinions may prevail regarding some of his suggestions. It is satisfactory to find that few New South Wales pigs were amongst those condemned.

Scalding a Large Pig.

It often happens that where a farmer does his own butchering, he has not at his command a cauldron large enough in which to dip the animal for scalding. Where this is the case he is forced to resort to one of several ineffectual means.

The best method is to thoroughly saturate old fine hay and cover the dead animal with it, packing it closely. Then pour the boiling water over it, leaving it until sufficiently scalded for the hair to slip easily. This method is much better than using blankets. While it may not be as effectual as dipping into the water, it has the advantage of saving much heavy lifting.—*The Cattle and Agricultural World.*

Report from the Commercial Agents.

Mr. Valder, Commercial Agent for New South Wales in South Africa, has submitted the following report on trade with South Africa to the Minister for Agriculture:—

Early last year the South African colonies arranged to start a Customs Statistical Bureau, the expenses of which were to be jointly borne by the various colonies interested. This Bureau, which has its headquarters at Cape Town, commenced operations in July last. Up till the establishment of the Bureau it was difficult to obtain up-to-date Customs returns, but now these are published monthly, quarterly, half-yearly, and yearly. The report for the half-year ending 31st December, 1905, is now to hand, and from it I have culled the following facts:—

Value of the Imports of all Merchandise into British South Africa, half-year ending 31st December, 1905:—

From British Empire	£12,078,815
Foreign Countries	4,457,901
Total	£16,536,716

Of the £12,078,815 from the British Empire, the following were the contributors:—

United Kingdom	£10,115,431
Australia	1,094,082
British India	324,083
Canada	251,786
Mauritius	232,008
Ceylon	28,863
Other parts of the Empire	32,562
Total	£12,078,815

The Australian total is, therefore, the second in the British Empire, and she is, apparently, the third largest supplier from any part of the world, the only foreign country to export more to South Africa being the United States, with a total for the half-year of £1,398,254, though Germany runs us closely with a total of £1,048,981. No other country sends more than half of this amount, Argentina coming next in order with £522,647.

The Australian total is made up as follows:—

Total Imports into British South Africa, half-year ending 31st December, 1905:—

From Victoria	£445,135
New South Wales	202,533
South Australia	147,558
Queensland	122,425
West Australia	9,062
Tasmania	7,569
New Zealand	82,179
Australia, *via* Delagoa Bay*	77,611
Total	£1,094,082

* The returns from Delagoa Bay show Australia only—they are not divided into States.

I have not yet been able to obtain complete returns of the imports for the first half-year of 1905, but I think that we may safely assume that the imports from Australia during last year reached upwards of £2,000,000.

Returns giving details regarding the various products imported are now coming to hand, and I will furnish reports regarding these as soon as they are completed.

Mr. G. Valder, under date of 21st March, 1906, reports as follows :—

Duty on Wheat and Flour—Natal.

It is notified in the Natal *Government Gazette* that the suspension of the Custom duty on imported wheat, and also on imported flour, &c., manufactured from other than South African wheat, now ceases.

This means that the duty will now be the same as that at the Cape, viz.:—

Wheat	1s. per 100 lb.
Flour	2s. "

It is believed that the Customs Conference now being held at Pietermaritzburg will slightly increase this duty. Any alteration made by the Conference will come into force on the 1st July next.

Mr. Valder has also submitted the following newspaper extracts :--

Natal Wheat Duties—Resentment at Durban.

Durban, March 20 (*Argus* Special Telegram).—The imposition of the suspended flour duty of 2s. per 100 lb. is strongly resented here. It is the first time flour has been taxed in the colony, and as it was one of the conditions of Natal joining the Customs Union that the duty should be suspended, the *Mercury* declares that the Government is guilty of a breach of faith in removing the suspension without the consent of the Legislature. A considerable increase is expected in the price of bread.

Dearer Bread.

Maritzburg, March 21 (Reuter).—Owing to the reimposition of the suspended duty of 2s. per 100 lb. on imported wheat, the bakers propose an increase of ½d. on the 2-lb. loaf, which will then cost 4d. at the counter and 4½d. delivered. Strong public feeling has been evoked by the imposition of the duty, more especially as no wheat is grown in the colony.

Dairy Notes.

Government Imported Cattle and their Progeny at Sydney Show.

M. A. O'CALLAGHAN.

The progeny of the Government imported cattle are now getting so well distributed, that at almost every show in the dairy districts some are to be met with. At the last Sydney Show there were a few prominent instances.

The Holstein bull, "United States," by Garfield (imp.), from Nobeltje (imp.), shown by Mr. S. Cornwell, was first in his class, and reserved champion for all ages.

"Flaxy's Prince."

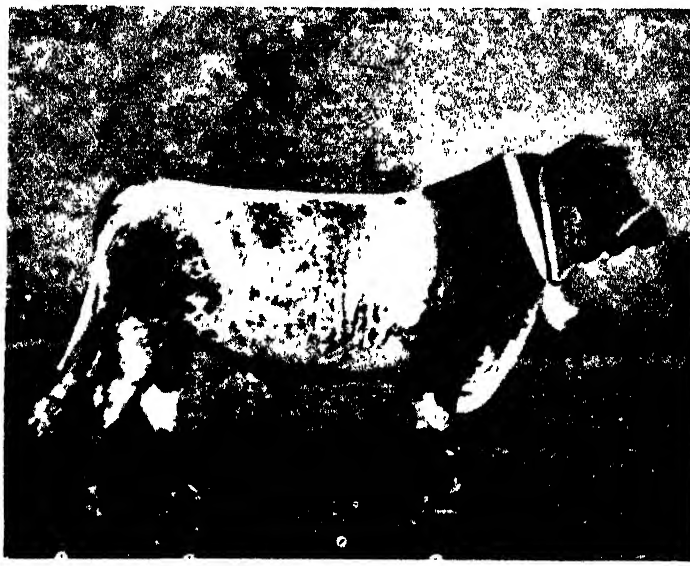
"Flaxy's Prince," a young Guernsey bull, shown by Mr. Sylvester Browne, was first in Guernseys. He is by the noted sire Rose Prince (imp.), from that great cow Flaxy (imp.), and is seventeen months old. See photographs.

In the dairy Shorthorn classes, however, the most noted descendants of the Government bulls appeared.

"Skipper," who has on previous occasions been champion at Sydney and Melbourne shows, was again placed first in the aged bull class. He is by the imported bull Clipper, and is owned by Mr. P. H. Morton.

Another bull by Clipper that some judges preferred, even to Skipper, was placed third in this class. This is the roan bull "Clifton," who was afterwards sold to a South Coast breeder.

In the class for one year and under two, Mr. George Tate won with "Aristocrat," a roan bull of great quality, and a grandson of the imported State



"Skipper," (Milking Shorthorn Bull).
Champion. Melbourne, 1905; Sydney, 1905.
The property of Mr. P. H. Morton.

bull Favourite. Next to him came James Brothers' "Quick March" (see photograph), by the Government bull Earl March, from Katie 2nd. Earl

"Aristocrat."

March was by Lord Sandgrave (imp.), from March Daisy (imp.). This young bull was sold during the show to a Richmond River farmer for £100. He comes of a very good milking family.

There were forty-eight entries in this class in which these bulls were first and second. While on Shorthorns, I might state that Mr. Kirk, a Richmond River farmer, bought the roan bull calf "Earl of Oxford," exhibited by

"Quick March."

the Berry Stud Farm in the non-competitive exhibits at the Sydney Show. He is a beautifully bred animal, being by Earl March from Oxford's Fanny Fanny 78th is his grand dam, and she is well-known as one of the pick of the importation.

"Earl of Oxford."

Another calf sold at the Show by the State Stud Farm was the young Holstein bull "Constitution." Mr. Sylvester Browne, of Whittingham, was

the purchaser, and on appearance and breeding this calf has in him the making of a champion. He was a non-competitive exhibit. He is by The Hague, perhaps the best descended Holstein for milk that the Government has bred.

Next month I will deal with some of the other cattle shown.

"Constitution."

Brief Hints to Dairy-farmers.

The normal temperature of a cow varies from about 100 degrees to 102·5 degrees F. When the milk is in the udder it stands at this temperature. When the calf drinks from the mother it takes the milk into its stomach at this temperature. Hence, follow Nature's teaching, and never feed cold or sour milk to young calves.

The milk when in the cow's udder, practically speaking, contains no micro-organisms. This is the condition in which the calf, as well as the butter and cheese maker would like to get it. Try and do this as nearly as possible. You cannot keep your milk free from micro-organisms, of which the atmosphere is full, but you can, by cleanliness, keep the atmosphere round your dairy comparatively free from injurious organisms.

Remember that the organisms that decompose farm-yard manure and cause it to smell will also ferment milk and cream to the disadvantage of all concerned. Hence, remove all manure and decaying substances from proximity to your milking bails and dairy. Keep all drains well flushed; and never leave sour milk or buttermilk lying about. They form a breeding ground for organisms which will later on taint the fresh milk and cream.

Milk your cows at regular hours daily, and never use the stockwhip or cattle-dog in bringing them to the bails. Above all things see that they get plenty of clear fresh water to drink, and place small lumps of rock-salt in troughs to which they have access.—M. A. O'Callaghan.

Orchard Notes.

W. J. ALLEN.

JUNE.

THOSE who have large orchards might, with advantage, begin the pruning of deciduous trees this month, as it will enable them to finish this important work in time to complete the spring spraying and ploughing before the trees break into bloom. In previous numbers of the *Agricultural Gazette* I have described how to do this work; at the same time I recognise how almost impossible it is to give such details as will suit trees of every age in the different districts. The orchardist must watch his trees and prune them from year to year in such a way as he considers will give him the best results. For instance, some trees by pruning hard back every year may produce fruit which is too large for commercial purposes. Such a tree therefore could with advantage have more wood left on in order to increase the number of fruit spurs and buds, as generally speaking it is found that the larger the crop is the smaller is the fruit. We should therefore endeavour to leave sufficient fruiting wood on a tree in order that it will produce a good crop of medium-sized fruit; that is after the trees have received proper manuring and cultivation, without which fruit-growing is not likely to prove a very profitable industry.

All young trees should be cut hard back for the first two or three years in order to start a low headed, sturdy tree; after which the orchardist must be guided by the growth made as to how much or little he will take off during either the summer or winter pruning.

In almost every orchard may be found trees which are not as profitable as they might be. These should be worked over to varieties which have been found to be most profitable in the district where they are growing, as it must always be borne in mind that some fruits thrive much better in certain soils and climates than in others, therefore the growers must see that those he is growing are the most suitable for his particular conditions, and that he is not trying to grow late fruits in a district where he could better grow fruits which are more suitable for the early trade, or *vice versâ*.

For those who intend curing lemons again this season, the early part of this month will be found the best time to pick the half ripe fruit. Avoid bruising while picking and handling, as fruit so damaged will decay quickly. Store in cases or boxes in a cool dry place. These cases are easily handled, as it will be found necessary from time to time to examine the fruit for the purpose of removing any which may have gone bad. Fruit above medium size, stored in paper lined cases, appears to keep better than small fruit.

Many of our growers are turning their attention to apple growing, as they find that there is a very big demand for such fruits, and there is no State which can produce better coloured or better quality fruit than the one we live in—New South Wales. Land suitable for apple-growing is cheap, and in place of growing sufficient for our own requirements, we have to depend on other States for about 750,000 cases every year. Surely there is something wrong with our apple growers when they allow such a state of affairs to exist. Many put it down to the want of a Codlin Moth Act. I hope, however, that whatever it is the remedy will soon be found, and that before long we will at least be able to supply our own requirements.

In our dryer districts such as Hay, Wentworth, Bourke, &c., where fruits are grown under irrigation and where considerable ground is being planted with currants, sultanas, and raisin grapes, the land should be ploughed and subsoiled as early as possible. Heavy clay soil should be avoided, as by planting such soils to fruit trees or vines nothing but failure can be expected. Therefore keep to the clay loam or loamy soils where the above fruits usually do best.

Have the land in readiness so that it may be planted in July if possible, or not later than the early part of August, in order to give the trees or vines a good early start in the spring.

Refills in all deciduous orchards should be planted this month.

Last year many of our apple growers suffered severely from apple scab. If those varieties which showed signs of this disease last year were given a little more attention, much of the loss caused by it might have been avoided; and, although it is rather early to speak about treating the trees for this disease, I would like to see those growers who suffered making proper arrangements to prevent a recurrence of the trouble this coming season.

Trees so affected must be thoroughly sprayed with Bordeaux mixture (winter strength) just when the buds are swelling; again, as soon as the fruit is set, with a weaker solution of the same spray to which has been added either Paris green or arsenite of soda. Many orchards would be greatly benefited by the application of lime, and the present is a very good time to apply same so that it will have had time to act upon the soil before the spring manuring. In frosty places young citrus trees should be covered without delay, if the work has not already been done.

It is not imperative that cultivation should be carried on in the orchard this month.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

Directions for the Month of June.

Vegetables.

The season during June is midwinter, but at time of writing—the middle of May—there is not much appearance of winter during the day; but the temperature is fairly cool at night. About the table-land, a few slight frosty nights have been noticed, but the weather is more a warm spring than winter. However, cold weather may put in a sudden appearance and clear away any vegetables like tomatoes, egg plants, and French beans, which have so far been growing and bearing well.

To produce early tomatoes in the spring some cuttings of any good plants now growing should be struck, and the plants kept under protection during the remainder of the winter. This is a good system to follow, not only to produce early fruit, but to keep tomatoes true to name. If seeds are kept of the kinds it is desired to grow, the chances are that if many varieties had been grown the seedlings from these will probably turn out to be crosses.

At the present time of year, the making of a vegetable garden could be taken in hand better, perhaps, than at any other period, and many kinds of vegetables would be coming on in the early spring. The soil should be carefully prepared and deeply worked even though the soil may seem to be of the highest quality.

Vegetable growing is, as a rule, but little attended to by farmers and settlers, indeed but few take the little trouble necessary to produce any vegetables or fruits. This is a deplorable state of affairs, and should be altered.

In one of the most fertile districts in the State, where these notes are now been written, it is a rare thing indeed to meet with anyone who takes the trouble to raise anything whatever for his family except wheat, and perhaps some sheep. An exception or two show what can be done, and how easily a great many kinds of excellent vegetables can be produced. The soil in this extensive district is excellent, rainfall good, water available in quantity by sinking a few feet; and abundance of manure to hand if manure should be necessary. It is the same thing almost everywhere, and the vegetables and fruits required are obtained generally from travelling vendors.

Artichoke.—Globe artichokes, which can be grown in many parts of the State as easily as thistles, may be planted from the present time until the spring. This vegetable is not a general favourite, although some persons like it very well. Plant either suckers or rooted plants, about 3 to 4 feet apart.

Artichoke, Jerusalem.—This is a different sort of vegetable altogether from the above, and a much better one to grow. The tubers should now be ready for digging; but as they will remain good in the ground until they start into growth, when spring returns, they may be dug as they are required.

Broad Beans.—The pods of early plants should be ready for gathering in some districts, for use. The seeds should be young and tender, for they are then better for the table than when they are matured and hard. Another sowing or two may be made during the month. Work the soil between the plants, especially during the early stages of growth.

Cabbage.—Sow a little seed, just in sufficient quantity to keep up a supply of plants. Advanced seedlings should be pricked out, and plants which have been pricked out, and which have become large and strong enough, should be transferred to ground prepared for them. With some little care and forethought a supply of cabbage can be kept up throughout the year Use a good dressing of well-rotted manure, even though the soil be naturally good.

Carrot.—Sow seeds in drills, on ground that had been used for cabbage or cauliflower, after it has been well dug up. Seedlings which are well above ground should be kept weeded and thinned out. Not infrequently carrots are grown too close together for want of thinning, and the roots do not grow so well as they should. The small varieties of carrots are the best to grow for home use.

Leek.—Sow a little seed in seed-bed, now and then, in just sufficient quantity to keep up a supply of young leeks for planting out. Any seedlings already raised, and which are large enough, may be planted. Use abundance of good manure, and water the plants well should dry weather set in.

Lettuce.—This useful salad plant should grow very well during the month. Sow seed to keep up a supply of seedlings. Transfer advanced plants to well-manured ground, taking a good deal of trouble to avoid breaking roots. The lettuce should be grown quickly, and, in order to do this, it will be necessary to make use of a good deal of manure, but let this be well rotted, if possible, before it is applied. It may be necessary to make use of liquid manure from time to time.

Onion.—Sow a little seed, either in seed-bed, or in the garden in drills. Seedlings from last month and previous sowings should be growing well, if they have been kept well weeded, thinned, and well cultivated.

Parsnip.—Sow seeds as largely as may be required, for the present time is favourable for sowing. The parsnip is a deep rooting plant and needs the soil to be free to a good depth.

Peas.—Keep up a supply of peas where possible, for the pea is one of the best vegetables we have. Neither peas nor any other vegetables except celery and leeks should have the earth drawn up to their stems, for it is quite unnecessary, and makes weeding and cultivating more difficult than if earthing up was not carried out.

Radish.—Sow a little seed from time to time during the month.

Herbs.—Seeds of various kinds may be sown, or plants may be set out if they are obtainable. Old overgrown plants of thyme and sage may be taken up, and portions of them planted in a new place. As a rule these and other herbs will grow well for many years without any necessity for removal if an occasional dressing of manure be supplied them.

Flowers.

In the warm parts of the State about the northern coastal districts chiefly, the planting of deciduous plants may begin, and also evergreens of any kind suitable for the locality. Before planting examine the roots, remove any that are broken, and smooth over by means of a sharp knife any ends of roots that are jagged or injured.

One of the most useful of all our garden plants is the rose, and everyone who has a garden should plant several varieties. Chiefly teas, or hybrid teas, which are valuable on account of their prolific flowering qualities, should be selected. The soil for them should be good, or if inferior should be heavily manured, and it should be well and deeply dug. Should the plants be dry, when received from the nurserymen, remove all wrappings, straw, &c., and bury them, stems and all, for a few days in damp soil. When planting, water well should the soil be at all dry. In any case it would be well to water them. Obtain and plant a few good kinds of carnations, but if this cannot easily be done, obtain seeds of the Marguerite kind and sow in pot or box. The seeds, if kept fairly moist, but not wet, should soon come up, and when the seedlings can be moved, prick them out and let them grow to the height of two or three inches, and then transfer to the garden. They will soon grow and flower, and most of these seedlings are likely to give satisfaction.

Plant out hardy annuals, and also any perennials obtainable. Pansies should soon make fine growth and flower well in the early spring, and in warm localities during the winter. Spring flowering bulbs, hyacinths, tulips, daffodils, all sorts of Narcissus, and others are appearing above ground. Avoid injury to bulbs, which are first starting, when digging about the garden.

Farm Notes.

Hawkesbury District—June.

H. W. POTTS.

The autumn is past, and we enter the winter with a gloomy prospect in so far as feed for stock is concerned. The early frosts this season, whilst not severe, are having an adverse effect on the young crops owing to the absence of moisture. The season is most unfavourable, and promises to rival in severity that of 1902.

The rainfall in April was 0·15 inches, and provided the driest record for that month ever taken at the College. The fall for the similar period in 1905 was 3 96 inches, and in 1904 7·961 inches.

May was equally dry, and hence the early winter crops have been severely checked in growth. The barley crops are not a success. The rainfall for the district since 1st January is not more than 7½ inches.

Scarcity of fodder for stock must prevail shortly, and with this serious position ahead of us it emphasises the urgency for conserving any fodder in some form or another.

Those who were fortunate enough to sow sorghum, and keep the crop growing by persistent cultivation during the dry months of summer, will now reap the benefit. Late winter and spring feed is bound to be scarce.

There is no crop which repays so well in a dry season owing to the labour and cost of its growth and cultivation. The plant, when mature, withstands the early frosts, and provides a green relishable forage for feeding horses, cows, sheep, and pigs in early winter. It is also eminently suitable for conserving as ensilage, chaffed into tub or pit silo, or preserved whole in the form of stack ensilage.

The weather conditions are also suitable for drying the crop when cut and stooked as hay. In this way it can be readily stored. No crop withstands rain better out in the open after cutting. The outer skin of the plant is hard, and resists the invasion of moisture.

When dried as hay, it may be converted into chaff, mixed with a proportion of lucerne hay, and used for stall feeding.

Another source of winter feed which should be taken care of is maize stalks.

Where the American system of maize harvesting is in vogue, the stalks are dealt with by converting them into stover. The McCormick husker and shredder is utilised for this purpose.

A stack of stover in the absence of green feed possesses a feed value which is fully appreciated by young stock and dry stock in winter.

In the absence of machinery, the stalks can be cut in the usual way and stacked ready for use. They can be fed whole, or chaffed and mixed with other classes of food to balance a ration.

It has been shown at the experimental stations in America that 37 per cent. of the total digestible nutrients in the maize plant are found in the stalk and 63 per cent. in the ear or cob. Further, the feeding value of maize stalks is sufficiently high when fed alone to keep an animal resting in a normal condition. It possesses half the feeding value of Timothy hay. In combination with other foods, it commends itself in the formation of a ration. It should practically be termed the roughage of the ration.

The practice is followed in many districts of burning the stalks after removing the cobs. In the face of a hard winter and a scarcity of fodder in the spring, it will be a wise act this season to save all maize stalks. Given with hay, ensilage or other available food for stock, it will have a commercial value this season in the absence of grass.

The dry season brings to mind the usefulness of Sheep's Burnet (*Poterium sanguisorba*, Linn.) as a drought-resistant fodder-plant. The experience of the last drought showed that this plant remained green and succulent during the driest periods, and afforded excellent food for sheep and cattle when other grasses and herbage were dried out of existence. This perennial fodder-plant is best sown in drills where the soils are dry, 5 lb. to the acre. It is hardy in character, and will thrive well on light soils. Its long tap-root enables it to derive its moisture from considerable depths. The plant grows about 18 inches high, and is especially relished by sheep. It is also well to sow it with other grasses in the pasture.

Swedes, Turnips, Cabbage, and Kale.—These crops will require attention during the month to keep them clean. Thinning must be resorted to, and a general system of cultivation kept up.

The final crop of Algerian oats may be put in. This variety gave the best returns during the series of dry years prior to 1902.

A further sowing of rape may be made. Should we have rain, this crop will pay well owing to its rapid growth.

The early wheat crops are not in a promising condition, but may be stimulated by harrowing and rolling.

Sweet Potatoes should be taken up, cleansed, and stored in sand for keeping purposes.

Advantage should be taken of any light fall of rain to transplant onion seedlings on rich, well-drained soil.

Glen Innes District—June.

R. H. GENNYS.

Barley may be sown for grain this month, but this crop requires land that has been well prepared and harrowed down very fine. It may be also sown for green feed or for hay. For grain, for malting purposes, the three that have done the best here are Albert, Invincible, and Eclipse; for green feed, Cape Barley and Skinless; the latter is the better sort for hay. Sow this rather thickly, as I have found it does not stool too well.

Rye may be sown for green-feed or for grain. For green feed, Emerald is a really good sort. For collar-making, White Rye has a beautiful straw and does well in these parts.

Onions may be sown. See that the ground is in good condition and free of weeds.

Oats may be sown for hay. Algerian and Red Rust-proof are good hay sorts, and the former is a large grain yielder. Other sorts that do well here are Potato (for feed) and Tartar King. White Tartarian, Golden Giant, and Danish Island are good kinds for cutting into chaff.

Sow *Peas*, *Cabbages*, *Cauliflowers*, *Parsnips*, and *Carrots*.

Wheat.—If not already sown, should be got into the ground with as little delay as possible. The beginning of this month in New England is by no means too late, but seed should be sown much thicker than in April or beginning of May. I consider one bushel to the acre should be put in with drill and $1\frac{1}{2}$ bushels to the acre if broadcasted. Wheats mature more quickly when sown thickly, which is of importance, as they are less likely to be attacked by rust than if they mature too late in the season the thunderstorm period setting in generally after Christmas. Land for wheat is better ploughed twice and should be got into good condition; and if a drill is intended to be used in sowing, all clods should be crushed up and stones and other obstacles removed. Do not sow your land when too wet. Ground planted when in a state of puddle never recovers its texture during the growth of the plant; in clay land this must be especially avoided. If land is poor and getting worn out, some commercial fertiliser, such as a soluble superphosphate, should be used at, say, 60 lb. per acre; but no hard-and-fast rule can be laid down, and every farmer should find out for himself what his land requires. This can be found out by experience and experimenting on a small scale. Gaining knowledge on this subject will be found of great importance to farmers. Much, too, may be gained by having an analysis made of the soils. Lime tends to sweeten all new sour land, and in heavy clay lands it improves the texture immensely. On wheat land put about half a ton to the acre of unslacked lime; leave in heaps till thoroughly slacked and spread over the ground.

Land should not be cropped year after year with wheat or any other cereal or exhausting crop, but should lie fallow for a time, or be sown with

rape and eaten off with sheep, or laid down with some leguminous crops, such as peas, beans, clovers, &c., which fix the nitrogen in the soil; these should be ploughed in, in the case of peas and beans; however, the pods may be gathered first.

Sowing, &c.—First of all, choose good grain, for small pinched seed cannot, it is evident, produce such vigorous plants as large plump grains; a grader, where practicable, should be used to effect this purpose. Before sowing it is necessary, in all cases, to treat the grain for bunt and smut. The quantity used on this farm, and recommended by such an authority as the late Mr. Farrer, is 1 lb. of bluestone to 80 lb. of water. Place the wheat in a bag, the texture of which is not too close—an ordinary chaff bag is as good as any; immerse the grain from seven to eight minutes in the solution and hang up to drain. If to be sown by hand, this may be done if required in a few hours' time; but if for the drill it should be spread out till thoroughly dry, so as to run at a fair speed in the machine.

After the crop is a few inches high it may be rolled, but in all cases should be harrowed immediately afterwards, and may be harrowed again and again, if the weather prove dry, as this tends to prevent the water rising by capillary attraction from escaping and being lost to the plant. If grain is sown in drills, it is better to harrow across the drills, as plants are less liable to be torn out. It is wonderful the refreshing effect of a good harrowing in a dry time. If wheats make too rapid growth early in the season, they may be cut or fed off by sheep or calves; but to do this habitually, whether too rank a growth is feared or not, has not been found to increase the yield but rather to decrease it. If intended to be eaten off by stock, the Manitobas seem to be least harmed by the process, but they should be sown very early.

Wheats that have done well on this farm, so far, are Power's Fife, Sussex, Jonathan, John Brown, Bolton's Blue-stem, Minnesota Blue-stem, and Federation; these are good flour wheats. And other wheats that have done well are Zealand, a good hay sort, Tardent's Blue, Nonpareil, Field Marshal, Plover, Rymer, and Schneider. Blount's Lambrigg and Lambrigg White Lammas also did fairly well.

Crown Lands of New South Wales.

THE following areas will be available for selection on and after the dates mentioned :—

FOR CONDITIONAL PURCHASE LEASE.

C.P.L. No.	Name of Land District	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
14	Lismore	acres. 6.8½	3	194 acres to 275½ acres.	Mullumbimby, 12 to 14 miles.	£14 11s. to £18 18s. 10d.	1906 28 June.

Generally rough broken hills and slopes, part basaltic formation with good chocolate clayey soil covered with dense brush; some open hardwood forest, sandy soil; the whole area suitable for dairying when cleared, fodder crops, &c, could be grown on frontage slopes; permanent water in Cooper's Creek.

12	Murwillumbah	3,126½	16	144½ acres to 289¾ acres.	Murwillumbah, 5 to 8 miles; railway platform at Stoker's Siding, ½ to 2½ miles.	£7 1s 6d. to £15 5s. 11.	21 June.

About half the area consists of undulating to hilly country; part good red, volcanic soil; part poor or light soil; covered with dense brush and jungle, and forest hardwood, a small proportion suitable for cultivation—sugar and maize; all suitable for dairying, the remainder is generally undulating, parts steep and stony; part good red volcanic soil, remainder light-coloured poorer soil; clayey subsoil; clothed with dense brush and jungle, interspersed with tallow-wood, box, flooded gum, ironbark, &c; a very small proportion suitable for cultivation; all suitable for dairying.

13	Murwillumbah	5,874½	24	134 acres to 320 acres.	Murwillumbah, 11½ miles to 18 miles.	£10 2s. to £21 17s. 4d.	21 June.

Mountainous country, of basaltic and sandstone formations; basaltic soil, with patches sandy and loamy, very stony in places; generally covered with dense soft-wood brush. small areas timbered with tallow-wood, gum, box, oak, bloodwood, &c.; generally not suitable for cultivation, although some of the blocks contain small areas which could be cultivated.

FOR ORIGINAL SETTLEMENT LEASE ONLY.

S.L. No.	Name of Land District.	Holding, &c.	No. of Farms.	Area of Farms.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
831	Hay	Benerembah Holding.	1	4,296½ acres.	Benerembah railway platform, 8 miles Narrandera, 46 miles; Darlington, 4 miles.	£ s. d. 107 8 3	1906. 26 July.

Level country, mostly open plain; brown, red, and grey soil: small quantity of box and boree timber, with gum on frontage; good grazing land, suitable for breeding and fattening; water permanent in Murrumbidgee River.

832	Warren .	Gunningbar Holding.	1	2,937½ acres.	Mullengudgery railway station, ½ mile.	88 14 6	7 June.

Level country, sedimentary formation: red and black soils; about one-third open forest of box, belar, and budtha, balance plain; no natural water supply.

For Improvement Lease.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Upset Annual Rental per Block.	Date of Sale or Tender.

Eastern Division.

490, 491, 493, and 494.	Cootamundry.	Berthong Holding (partly).	acres. 3,540	4	acres. 310 to 1,460	Wallendbeen, about 7 miles; Cootamundra Railway Station, 7 to 10.	£ s. d. 1 18 9 to 18 5 0	1906. Sale. 18 June.

Mostly ridgy country of very inferior quality; heavily timbered with ironbark and white gum, and a fair quantity of cherry, quandong, and silver wattle trees, better and more open country in the north-west corner of block 490 and along the west of block 491; the parts between the ranges on the forest reserves within block 491 are in a rich valley; parts of this have been cultivated and parts ringbarked, but suckers have grown up small areas in blocks 493 and 494 have been ringbarked and are suitable for agriculture; mostly gravel and slate on the forest reserves, but parts of the blocks contain a proportion of rich chocolate soil, except block 494, which is poor soil, better along the east boundary; scrubs of sifting-bush and hopbush. No permanent water supply, but fairly suitable sites for dams. Rabbits, wallabies, paddymelons, and bandicoots are numerous.

Central Division.

1,374 and 1,375	Coonabarrabran.	Weetaliba Holding.	acres. 20,850	2	acres. 7,850 and 13,000.	Coonabarrabran, about 30 to 40 miles. Quirindi Railway Station, about 90 miles. Mudgee Railway Station, about 100 miles. Gunnedah Railway Station, about 85 miles	£ s. d. 32 14 2 and 27 1 8 respectively.	1906 Sale 18 June.

Undulating sandstone country; soil red sandy loam, poor sand and sandstone; water supply a large dam and natural springs on block 1,374, and waterholes in Bolton's Creek on block 1,375, scrubs—black pine, wattle, heath, five corners, and undergrowth, rabbits exist Average annual rainfall, about 25 to 30 inches

1,382 to 1,385	Forbes .	Eugoura Holding	9,800	4	2,450 each	Eugowra, 1 to 5 miles, town and railway station of Forbes, about 21 miles.	4 18 0 to 5 15 0	Sale. 18 June.

Rugged granite and sandstone; mountains and ridges very rough and steep in places; timbered with a stunted growth of ironbark, currawong, black pine, and some she oak, and covered with scrub of pine, wattle, hopbush, and undergrowth, with some patches of better land openly timbered with box and gum along the gullies, coarse sandy soil of poor quality. Several small springs exist upon the land. Average annual rainfall, about 23½ inches Rabbits and wallabies are numerous, and dingoes are present

For Original Conditional Purchase only—(Classified under Sub-section (a) Section 4 of the Crown Lands Amendment Act of 1905).

Name of Land District.	Name of Holding, &c.	Parish.	County	Total Area.	Price per Acre	Date available.
				a. r. p.	£ s d.	1906.
Bellingen ...	..... .	South Bellingen	Raleigh	400 0 0	1 0 0	12 July.

Part suitable for grazing, densely timbered, and fairly well watered

*Lismore .	Within Byron Bay suburban lands.	Byron . .	Rous .	125 1 1	5 0 0	7 June.

Suitable for homes for persons employed in the vicinity

Paterson ..	....	Carrow .	Durham	40 0 0	1 0 0	7 June.

Being portion 72; part suitable for cultivation.

Wagga Wagga	Umutbee & Toonga holdings.	Tarcutta .. .	Wynyard .	40 0 0	3 0 0	19 July.

Good alluvial flats, suitable for agriculture.

* Identical with Special Area, see p. 652.

FOR ORIGINAL CONDITIONAL PURCHASE AND CONDITIONAL LEASE IN VIRTUE THEREOF—(Classified under subsection (*a*) section 4 of the Crown Lands Amendment Act of 1905).

Name of Land District.	Name of Holding, &c.	Parish.	County	Total Area. a.	r.	p.	Price per Acre. £	s.	d.	Date available.
										1906.
Bathurst ..	....	Irene.. .. .	Westmoreland.	400	0	0	1	0	0	12 July.
Fair to good grazing land; parts suitable for cultivation.										
Bega .. .	... .	Colombo and Mogila	Auckland ..	10,800	0	0	0	8	4	7 June.
Rough, rugged country; heavily timbered.										
Bellingen	....	Never Never ..	Raleigh .	850	0	0	2	0	0	12 July.
Suitable for dairying, fronts Bellinger River.										
Carcoar	....	Yewrangara	Georgiana ..	810	0	0	0	15	0	19 July.
Inferior to fair grazing land.										
Carcoar ..	....	Bingham . .	Georgiana ..	1,420	0	0	0	13	4	26 July.
Suitable for grazing.										
Carcoar ..	....	Yewrangara .	Georgiana ..	410	0	0	0	15	0	26 July.
Suitable for grazing										
Casino .. .	Within Resumed Area 752.	Powerpa . .	Richmond ..	550	0	0	0	15	0	19 July.
Fair to good grazing land; well watered										
Condobolin .	.. ..	Willama	Cunningham	2,410	0	0	0	10	0	14 June.
Suitable for grazing.										
Cootamundra .	....	Warie Warral	Clarendon ..	360	0	0	2	0	0	26 July.
Suitable for grazing and agriculture, dairying, &c.										
Cowra .. .	.. .. . .	Tintern . .	Bathurst	1,370	0	0	1	0	0	12 July.
Fair grazing land; parts suitable for cultivation.										
Goulburn ..	....	Cookbundoon and Eden Forest.	Argyle ..	1,200	0	0	0	8	4	5 July.
Poor grazing land; unsuitable for agriculture.										
Gunnedah and Narrabri.	.. ..	Wean	Nandewar	2,400	0	0	0	6	8	21 June.
Poor grazing land.										
Gunnedah .	Bando Holding	Bando .	Pottinger	85	0	0	2	10	0	5 July.
Good pastoral land; nearly all rich black soil.										
Gunning	.. ..	Kildare .	King .	205	0	0	0	10	0	5 July.
Land of poor grazing capacity.										
Maitland .	....	Milfield . .	Northumberland.	100	0	0	1	0	0	14 June.
Suitable for grazing.										
Moree .. .	Caidmurra Holding (partly).	Young ..	Benarba	2,133 2,256	0 0	0 0	1 1	0 3	0 4	21 June
Suitable for grazing; sound country for fattening or breeding.										
Murrurundi ..	.. ..	Lincoln .	Brisbane .	1,280	0	0	1	0	0	26 July.
Suitable for grazing.										
Murwillumbah ..	... .	Cudgen .	Rous	220	0	0	2	0	0	26 July
Suitable for cultivation and dairying.										
Narrabri .	Lindsay Holding (partly)	Muln, Connor, and Lindsay	Nandewar	13,300	0	0	0	10	0	7 June.
Suitable for grazing when cleared, not suitable for agriculture.										
Newcastle ..	....	Teralba .. .	Northumberland	62	3	0	1	10	0	5 July.
Suitable for grazing.										
Newcastle .	....	Coorumbung	Northumberland.	2,300	0	0	1	0	0	12 July.
Fair grazing land.										
Tenterfield .	... .	Frazer . ..	Clive	465	0	0	0	16	8	19 July.
Suitable for grazing; a small part suitable for cultivation.										
Young	Moonbucca Holding.	Yerad .	Bland	430	0	0	1	5	0	5 July
Good grazing land; part suitable for wheat-growing										

FOR CONDITIONAL PURCHASE (ORIGINAL OR ADDITIONAL) AND CONDITIONAL LEASE, IN VIRTUE THEREOF—(Not classified or specially set apart under section 4 of the Crown Lands Amendment Act of 1905).*

Bombala .	.. ..	Grenville ..	.. Wellesley	320	0	0	1	0	0	28 June
Casino .	. .. .	Tomki ..	. Rous .	245	0	0	1	0	0	26 July*
Moss Vale .	.. ..	Yarrawa	.. Camden	100	0	0	1	0	0	12 ,,

*Suitable for grazing.

SPECIAL AREAS.

Lismore Land District, within the suburban boundaries of Byron Bay, 125 acres 1 rood 1 perch; maximum area, 18 acres 2 roods; minimum area, 5 acres 3 roods 14 perches; situated ½ to 1½ miles from Byron Bay; suitable for homes for persons employed in the vicinity, price, £5 per acre. Available 7 June, 1906.

Lismore Land District, within the suburban boundaries of Ballina, 9 acres 0 roods 7 perches; maximum area, 9 acres 2 roods 0 perches; minimum area, 4 acres 2 roods 0 perches; situated 1½ miles from Ballina; basaltic formation, with chocolate soil, suitable for grazing and agriculture, timber—dense soft wood brush, with a few trees of mahogany, box, and gum, no permanent water, but may be obtained by sinking about 5 feet; price, £5 per acre. Available for additional applications only on 7 June, 1906.

AGRICULTURAL SOCIETIES' SHOWS.

1906.

Society.	Secretary.	Date.
The Central Australian P. and A. Association, Bourke	G. W. Tull ...	June 6, 7
Deniliquin P. and A. Association	L. Harrison ...	July 19, 20
The Lachlan P. and A. Association	Thos. Cadell ...	July 20
Hay P. and A. Association	G. S. Camden ...	,, 26, 27
National A. and I. Association of Queensland ...	.. ..	Aug. 7 to 11
Forbes P., A., and H. Association	N. A. Read ...	,, 8, 9
Corowa P., A., and H. Society	H. L. Archer ...	,, 14, 15
Parkes P., A., and H. Association	G. W. Seaborne ...	,, 15, 16
Murrumbidgee P. and A. Association (Wagga) ...	A. F. D. White ...	,, 22, 23
Cootamundra A., P., and H. Association	T. Williams ...	,, 28, 29
Gunnedah Show	J. H. King ...	,, 28, 29, 30
Northern Agriculture Association (Singleton) ...	C. Poppenhagen...	,, 29, 30, 31
Yass P. and A. Society	W. Thomson ...	Sept. 4, 5
Manildra P. and A. Association	E. J. Allen ...	Sept. 5
Junee P., A., and I. Association	T. C. Humphrys...	,, 5, 6
Grenfell P., A., and H. Association	Geo. Cousins ..	,, 6, 7
Albury and Border P., A., and H. Society	W. J. Johnson ...	,, 11, 12, 13
Young P. and A. Association	Geo. S. Whiteman	,, 12, 13
Wyalong District P., A., and H. Association ...	S. G. Isaacs ...	,, 18, 19
Germanton P., A., and A. Society	Jas. S. Stewart ...	,, 19, 20
Temora P., A., H., and I. Association	W. H. Tubman ...	,, 25, 26
Lockhart A. and P. Society	R. O. Drummond	,, 26
Lismore A. and I. Society	T. M. Hewitt ...	Oct. 31 & Nov. 1

1907.

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Upper Hunter P. and H. Association, Muswellbrook	Pierce Healey ...	,, 21, 22, 23
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[2 Maps, 1 Plate.]

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Fruit Canning and Bottling.

W. J. ALLEN AND S. A. HOGG.

FROM year to year we find that the consumption of fruit, either in the fresh state or after it has been converted into canned fruit, jam, jelly, or the dried product, is increasing, and when one thinks of the benefits to be derived from a fruit diet during the hotter months of the year, as compared with the meat three times a day menu, which until quite recently held undisputed sway in nearly every household in Australia, it is matter for congratulation that our people have at last awakened to the fact, and also that the excellence of the home-made product is such, that it has so quickly gained in favour,

General View of Cannery.

and commended itself to the consumer; because it must be borne in mind that but a few years back—a matter perhaps of ten or twelve years—all the fruits used in this country were imported from the United States or the Old Country; but with the increase in the fruit-growing industry, and the consequent question of disposal of crops when the trees came into bearing, the necessity thus created compelled those engaged in making jams in a small way to increase their operations, and also to look to the improvement of their methods, offering great possibilities for those with sufficient capital to take up this business in its different branches on a large commercial scale.

A

At the present time the canning of fruits and converting them into jam furnishes profitable employment for hundreds of hands during the season, and as our factories turn out only high-grade products, they are finding an ever-increasing demand for same. In our large jam factories the processing of fruits has become almost a mechanical operation, and the cost of handling fruit and tins has been reduced to a minimum. Making the tins, testing, filling, capping are all done by machinery, and require but a few hands to supervise the whole operation. By this means the work is quickly and cheaply done.

It is not so many years ago that Australian jam did not commend itself too highly to the Australian consumer, but now our products are second to none on the market, and have practically ousted the imported article. In Sydney at the present time we have some very large jam factories, which yearly convert into jam and canned fruits hundreds of tons of fruit.

A frequent complaint from the proprietors is a shortage of the higher-grade peaches and apricots for canning purposes. It would, therefore, be well for those growers who are situated in districts where peaches thrive well, and where there are not too many pests to fight, to grow largely of those varieties which are most suitable for canning purposes.

Those who have fruit at their command, whether it be on the farm, station, orchard, or city, can with very little trouble put up sufficient canned fruit and jams to supply their wants throughout the year. The fruits may be put up in glass bottles or tins. At many of our country shows one is confronted by very fine displays of such home-made products, which reflect the highest credit on the operators. While requiring the exercise of scientific principles, the art of canning and jam making is yet so simple when clearly understood, that it is of easy application, whether practised on a large scale or in the more modest scale of the kitchen.

Heat is the all sufficient, safe, and sure steriliser for the canning business. It is sure death to all ferment organisms, purifying in its effect, and imparting no hurtful property or quality. A clear understanding of this principle leads at once to successful work in canning fruits or converting them into jam. Success depends on careful work in every particular, in filling and sealing the cans, and in sterilising them during the process of cooking.

Before going into the details of canning, it will not be out of place to give the names of a few of the most suitable varieties to be used for this purpose. It must be borne in mind that only sound and high-grade fruits should be used, and that cleanliness is one of the prime factors to success. It is erroneously thought by some that inferior and low-grade fruits are suitable for canning, and only too often are such fruits used for this purpose, greatly to the detriment of all concerned. On this subject, it may be well to mention that the question of size is one of importance, and the following list will act as a guide on this point:—

Peaches should measure not less than 2½ inches in diameter; Bartlett pears (commonly known as the Williams or Williams's Bon Chrêtien), 2½ inches and

upwards; cherries, ¾ of an inch; plums, not more than ten to the pound; apricots, not more than eight or nine to the pound. What is really required are neither small nor very large fruits, but medium to large in size, so as to facilitate the packing, and to do away with the necessity of having to divide them into more than two parts.

The following fruits are some of the best of their respective kinds, viz.:—

Apricots.—Hemskirke, Mansfield Seedling, Alsace, Moorpark, and Peach.

Cherries.—Florence, Bigarreau Napoleon, Early Lyons, and St. Margaret; Montmorency (this variety is also the most suitable for jam-making).

Figs.—Brown Genoa, White Genoa, Brown Turkey, and White Adriatic.

Peaches.—(Freestone) Elberta, Early Crawford, and Lovell; (clingstone) Lemon Cling, Orange Cling, California, Nicholl's Cling. The above are all yellow-fleshed varieties. For white cling peaches, McKevitt's Late and Large Early White.

Plums.—Jefferson, Magnum Bonum, Angelina Burdette, and Giant Prune.

Pears.—Bartlett, Easter Beurré, Le Conte, Kieffer's Hybrid.

Quinces.—Missouri, Champion, Portugal, and Pear-shaped.

This article is written with a view of assisting the small canners, and in no way claims, in its illustrations, the modern appliances of a large factory; but, on the contrary, simply gives the necessary requisites, from which a few hints may be gathered. The articles in use are substantial, cheap, and answer the purpose. In the present instance steam is being used as a medium for boiling; but although this is very convenient, it is not indispensable, and a copper for a small quantity, or a 200-gallon tank cut in halves and set in bricks, will answer for a limited output.

Selection of Fruits.

These should be ripe, but not soft (this does not apply to pears). All fruit should be handled carefully, and it is advisable to pick into small cases, so as to avoid bruising—say not more than 30 lb. in each case. Upon arriving at the cannery, the first process is that of grading. The table shown in Fig. 1

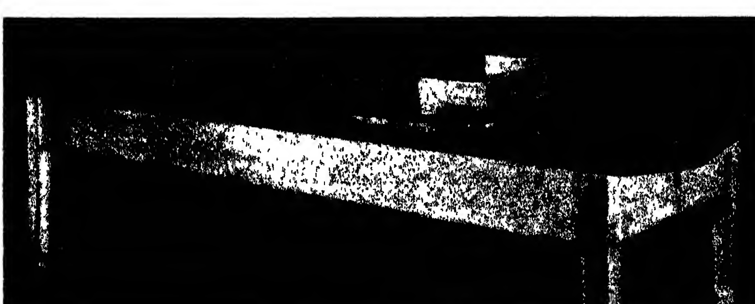


Fig. 1.—Grading Table.

illustrates the grading-table, which measures 10 feet x 4 feet x 2 ft. 9 in. in height, depression 2½ inches. Upon this the fruit is gently placed and graded. It will be observed that this table is lower in the centre than the

surrounding edges. The advantage in having it thus is, that with such a formation, the fruit always inclines towards the centre, and prevents, in a great measure, the tendency to fall upon the floor.

After the fruit has been graded by hand, it is placed in convenient boxes or buckets and carried across to the packing-table, which is illustrated in Fig. 2.

Packing-table (Fig. 2).—As shown, this table is wholly constructed of wood, with a trough in the centre. This is made in the shape of a V,

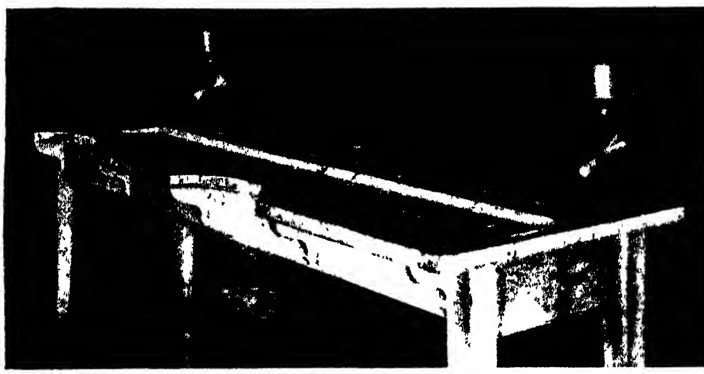


Fig. 2.—Packing Table.

being 14 inches across and 7 inches in depth. Spaces are cut out, so as to accommodate four packers, and the edge is surrounded with galvanised hoop-iron, projecting above the table half an inch. This is to prevent the operator becoming splashed with water. Into this trough the fruit is emptied (having been previously peeled, or pitted when necessary—this will be explained later on), washed, and packed in the cans, care being taken to place the same weight of fruit in each can. As shown in Fig. 2, small scales may be used as a check.

Fig. 3.—Syrup Tank and Table.

Syrup Tank and Table (Fig. 3).—This table is constructed mainly of wood, with a galvanised or enamelled trough let into the front. The height

is 2 ft. 9 in., and 4 feet long by 3 feet in breadth. The surface is grooved, starting 2 feet from the back, and running in the direction of the trough. These are so made, that in case of any syrup being spilt it will be conveyed into the trough (trough 12 in. × 6 in.), a tap being inserted into the bottom of the latter by which such surplus syrup may be drawn off, strained, and re-used. Upon this table stands a tank containing 10 gallons of syrup, which is used for filling the cans. A little in front of the tank, to the left, is placed a slide—known as a gauge—which is used as a check in filling the cans. The gauge is set at such an angle that it will discharge any superfluous syrup; and it is placed inside the trough, and the tins slide down it, so as to ensure equal filling. It will be noticed in the illustration that a single can is standing under the tap, but usually a crate containing six cans is used.

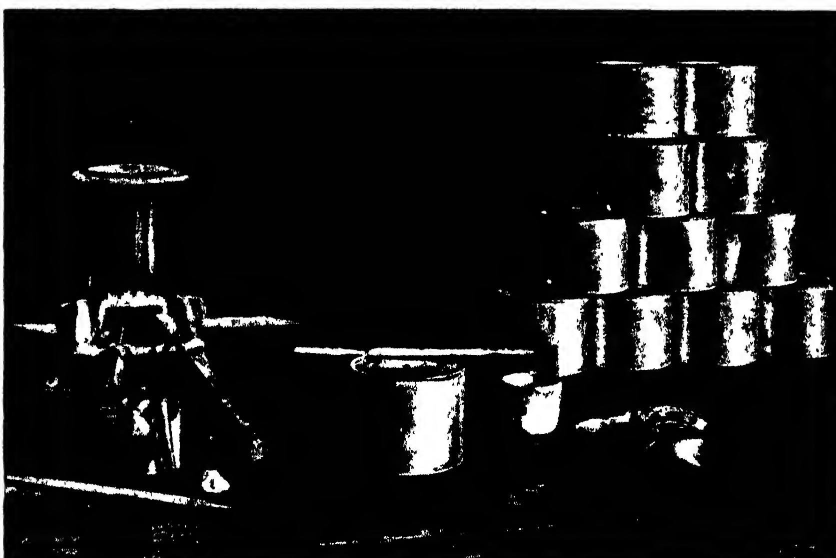


Fig. 4.—Soldering Table and Accessories.

Soldering-table and accessories (Fig. 4).—This table is of no special construction, but it is advisable to place on it a sheet of galvanised iron in the vicinity of the work. Also, all the necessary materials should be ready to hand.

Materials used in Soldering.—Copper, lead, tin, zinc, sal-ammoniac (ammonium chloride), muriatic acid (hydrochloric acid).

Copper.—Copper-bit or soldering iron may be purchased of any weight, or copper may be procured in bars, and converted into any shape required.

Lead and Tin.—These comprise the component parts of solder. To make good solder, melt down equal parts lead and tin at the same time, and pour into moulds not more than ½ inch in breadth.

Soldering Fluid.—Muriatic acid, zinc, and water make the following solution:—Take 1 pint acid, and place in earthenware jar; then add sufficient zinc until all ebullition has ceased. Strain, and add ½ pint of water. This is for tin only.

Sal-ammoniac.—This acts as a flux with copper, and is used in cleaning the soldering-iron; but should be kept away from all steel tools, as it rusts them very severely.

Horsehair Brush.—This can be made by placing the hair between a piece of bent tin, and then squeezing it together.

Tinning the Iron.—With a rasp, clean the iron until it is bright; that is, after it has been heated sufficiently. At this stage you can let it get red-hot, and then rasp it; then allow the iron to return to a dull heat. Having placed a piece of solder somewhere handy, you dip the iron into the zinc solution, then apply it to the sal-ammoniac, at the same time rubbing the iron with solder. By degrees the iron will become tinned. This solution is not broken down to the same extent as that used for soldering the cans, and should contain some sal-ammoniac, which may be powdered and dissolved in it.

Shake off any superfluous solder.

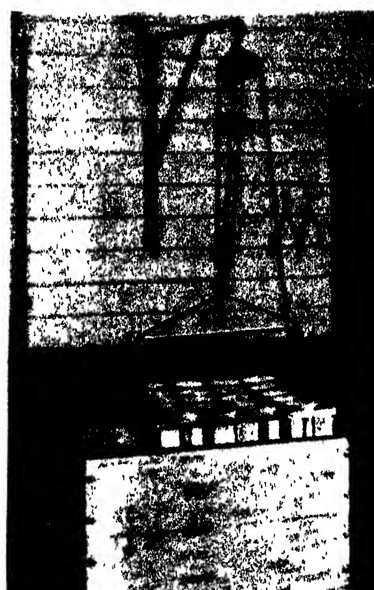


Fig. 5.—Cooking Bath and Crane

Cooking Bath, Lifting Crane, Crate, and Tongs (Fig. 5).—This bath, 3 ft. x 2 ft. 6 in. x 2 ft. in depth, is made of wood and lined with sheet-copper; inside, on the bottom, is a steam-coil; resting on top is an iron crate containing the tins, which are raised or lowered by a pulley as occasion may demand. Two pairs of tongs are provided for handling the tins whilst hot.

Steam Retort (Fig. 6).—This is a square steam-tight receptacle, which may be used, after the tins have been tested, for cooking either fruit, vegetables, meats, &c, the advantage of a retort being that as the temperature can be raised far above boiling point, the time of cooking is correspondingly less.

For instance, in the cooking of peas, these are shelled, washed, and placed in boiling water for twenty minutes, the water can then be drained off and cans filled to within half an inch of the tops with peas; pour in 10 per cent. brine to within a quarter of an inch of the aperture (a little sugar being added), and

Fig. 6.—Steam Retort.

cap, leaving a small hole in the lids for exhausting. They are boiled for ten minutes; the hole is then soldered up. If cooked in open bath containing saline solution, at 230 degrees F., one hour; if in retort, at 240 degrees F., thirty-five minutes.

(*To be continued.*)

Breeding of Dairy Cattle.

Mr. P. F. Quirk delivered a lecture in the School of Arts, Berry, on Monday night, the 30th April, on the above subject.

The President (Mr. H. D. Morton) occupied the chair, and explained that the meeting had been called by the Berry Agricultural Association, at the instance of the Department of Agriculture. He was pleased to see not only so many old farmers, but a good sprinkling of the younger ones also.

The attendance was large, many dairymen from a distance being among the audience.

The paper was illustrated by a number of diagrams, and their explanation was followed with considerable interest.

Mr. Quirk said :—The question of breeding up the dairy herd is, perhaps, the most vital question in dairying to-day. The question of the milk-yield of a cow depends chiefly on her inherent milk-yielding capacity. This is a hereditary quality ; and such being the case, the milk-yielding capacity of a herd of dairy cows can largely be increased by careful selection and breeding. In herds, where a large milk-yield is desirable, special attention must be paid to using in the herd only those heifers which have been bred from the best cows of deep-milking qualities. The heifers from poor milkers and badly-formed cows should, on no account, be retained, as they will have inherited the qualities of their mothers. When we consider that many of our dairy cows yield only 150 lb. of commercial butter per annum, while cows on the same pasture are yielding up to 400 lb. commercial butter, you will readily understand the possibilities that exist to grade up the dairy herd.

How are we to set about grading up our herds ? In my opinion, the farmer should be guided by local and climatic conditions, also the nature of his pastures. He should consider well before making a selection, especially in new districts, so that there will be no turning back ; for how often do we find men breeding in a certain line for years, and then finding out that he has made a poor choice, and that other breeds of cattle would be more adapted to his conditions ! With the result, those years are wasted and he is forced to make a fresh start. Now, having decided upon the class of cattle he wishes to breed, he should have indelibly imprinted upon his mind the true type of a dairy cow, and breed for that type ; or, in other words, to have that particular goal to aim at. The question arises, How is the breeder to attain that standard of perfection ? By selecting heifers from deep-milking families, and continuing this process for a sufficient length of time the average milk-yield will be considerably increased. The great fault with the average dairy-farmer is, that he stints the feed. If you are to get the best results from your cows you must feed them. The original cow was not an ideal dairy animal—she has been made one by selection and feeding

therefore, if we neglect these two things, how can we hope to improve our herds ?

Breeding from good milkers, whose parentage is known, will invariably produce calves which, later on, will also give a large milk-yield. Breeding from animals whose parentage is unknown, or which are cross-bred, must, at the best, be only guesswork, and very uncertain and unsatisfactory in its results. We may possess cows which are heavy milkers, yet their heifer calves may fail to possess the same desirable qualities. As a rule, however, it will be found that good milking cows produce equally good milking heifers, provided they have been bred to a suitable bull. This is due to the fact that deep milkers generally come from good milking families, and their milk-yielding capacity is an inherited quality and not of accidental appearance; for it must be remembered that it is not possible to feed a cow beyond her maximum ability to produce butter-fat—that is to say, if a cow's maximum quantity is 12 lb. of butter per week, it is not possible to feed her for any length of time to produce, say, 14 lb. of butter per week, even with the aid of the richest and most concentrated foods, for breed plays a more important part than feed.

Selection of Bulls.—Earnest attention should be paid to the class of sire which is used in the dairy herd. The sire should be, if possible, pure-bred, and a descendant from a deep-milking strain. This point is one of very great importance, but very often entirely neglected. A great many dairy-farmers pay very little attention to this matter, but use any kind of animal, so long as he can get calves. It is a great mistake to suppose that because a bull is pure-bred he is necessarily a good dairy animal. Every bull that heads the herd should be there because he is known to be from the best milk-producing females available, and from the best strains on the sire and dam's side accessible. Still, we should all aim at a pure-bred sire. It must be remembered that the sire influences the milking qualities of all the heifers in the herd. This evident fact is frequently overlooked. Unless, therefore, the breeding of the bull used for service in the herd is attended to, little and uncertain progress can be made in the improvement of the milking capacities of the heifers bred, and which are eventually drafted into the herd. In fact, by breeding from a bull descended from a poor milking strain, the benefit accruing from retaining for breeding purposes only good milkers is, to a certain extent, negatived, according to the degree of prepotency of the bull. Only if both parents are descended from great milking strains can it be expected that the progeny will be good dairy cattle.

While on the subject of sires, I would like to say, in passing, that, in my opinion, many dairy-farmers act unwisely in disposing of their aged bulls, just at the time when they are able to form an accurate opinion as to their value as sires. It is an old and a wise saying, "Judge a bull through the heifers he produces." Now, it is almost impossible to say, with any degree of accuracy, what class of heifers a young sire will produce; it is not until his heifers are coming into profit that one can be sure of results. If your bull nicks well with your herd, and the progeny are up to expectations, or

beyond it, why dispose of such a sire? The answer invariably is, his heifers are coming in, and you must dispose of him. Is this not a mistake? Would it not pay fourfold to keep this proved sire for the old cows, or what might be termed the working herd, and purchase or use your young bull with the heifers? By this system, if the young bull's stock did not prove a success, you have the satisfaction of knowing there are some fine heifers coming along, the progeny of the tried sire, to replace your old cows. My system was, when dairying, to purchase a tried sire, and judge him through his heifers. How often have we heard the remark, "I had a bull, purchased from a certain breeder; I kept him for a few years; his heifers were coming along; so I disposed of him for a few pounds; his heifers were the best in the yard; I'm sorry I did not keep him longer"! Thus proving the sire at the head of the herd must be judged on appearance, breeding, and results.

Inbreeding.—This is a very vexed question, and one that has occupied the minds of breeders for generations. We find, on looking up the pedigrees of many of the English stud cattle, that they are bred on what is termed "line breeding." A certain bull is selected because he fills the breeder's ideal. The method henceforth pursued and continued is to select his best calf in successive years, and use him on the females which are least closely related to him. Thus, in time, the pedigree or the breeding of the different females in the herd are worked pretty much on the principle of a corkscrew. Now, suppose the bull that filled the breeder's ideal and first headed the herd to be a vigorous, prepotent animal, he will have stamped his type on the whole family. But this method of breeding generally runs to the danger point where inbreeding begins to tell adversely upon the constitution and fertility of the herd. It is a fact that, when inbreeding is pursued to the extent of seriously injuring the constitution of a herd, there is no more dangerous animal to use than a bull of this class. While I am adverse to inbreeding, it may have its advantages. Say a breeder wishes to build up a herd of Guernsey cattle—I take these, as they are a new breed. He owns a few grade-bred Guernsey heifers, say, by "Rose Prince," and those heifers were well grown and of strong constitution, I would have no hesitation in serving them with a son of "Rose Prince." By this method you would stamp the type of the Guernseys; but I would go no further on this line of breeding, as this class of cattle would not hold their constitutions with inbreeding to the same extent as beef cattle.

Crossing.—This is a question discussed the world over, with very little result. Naturally, breeding is not a mathematical certainty; and we cannot foresee the results. To breed up a herd means to start with a lot of females of no particular breeding and with a bull of excellent breeding and good individual character. Then, breeding should be continuous in the same line, using bulls of the same breed, that the prepotency of the sires may continue to be the dominant factor in determining the quality of the calves. Now, true crossing is to mate two pure animals of different breeds, and the result will be a cross-bred such as a Shorthorn-Ayrshire cross. The point I wish to make is that our farmers do too much crossing; you will find in many herds a trace of

Shorthorn, Ayrshire, Holstein, and Jersey blood running through their veins. Little wonder many of the offspring are sports. There can be nothing gained by this zig-zag crossing. If you intend crossing select two breeds, say Shorthorn and Ayrshire, and keep to those breeds, just keeping as much Ayrshire in the herd as you can hide, with the Shorthorn characteristic predominating; still a little more Ayrshire may be used for cold climates. I mention this cross merely as an illustration, not that it would be my favourite cross. I am very keen on the Guernsey-Shorthorn cross, not that we have had much experience with that cross, but Shorthorns being large milkers, with only a moderate test of about 3·7 per cent. of butter-fat, and Guernseys being good milkers, with a very high test, averaging about 5 per cent.; now, by mating those breeds you would have a large amount of milk on one side and a fair amount of milk with a high percentage of butter-fat on the other, and the result should be a cow of very high order. I feel confident this is the coming cross for dairy herds, except in very cold or hilly country. The question that naturally arises, "What would you mate this first cross with?" I should go on with the Guernseys. If my desire was not to have pure Guernseys I would use, after the second cross, a Shorthorn bull and work with the two breeds. This would tend to keep up the size. Cows bred on those lines should play an important part in our milking competitions.

Telegony, commonly called absorption. The meaning of this term in cattle parlance is the influence of a previous sire on the calves of a subsequent one through the same dam that is to say, a Shorthorn heifer is served by an Ayrshire, Jersey, or by a cross-bred animal and she produces a calf; again, on her second calf she is mated to a pure-bred Shorthorn bull;—will the previous sire have any influence on the second calf? Now this is a very debatable question. We shall leave the scientific part to the scientist, and approach the subject from a practical standpoint. My experience has proved that telegony occurs in dogs, and is very pronounced with these animals. It has also come under my notice, in several cases, where a blood mare was served accidentally by a draught horse, and had the next foal to a blood horse, and the second foal had all the characteristics of the draught horse. I have seen cases also in cattle where telegony was very pronounced. Now my opinion is, a heifer having a first calf to a scrub bull, or a bull not of her own breeding, cannot be relied upon to produce a clean bred calf. I think telegony is more pronounced when it occurs with young animals on their first calf, than with older cows. Now, assuming that telegony does occur, there is a lesson to be gained: and that it is an unwise act to allow a scrub bull to run with our young heifers, and involving the risk of those heifers in after life throwing back to this scrub bull.

Selection.—A good cow is the foundation of all successful dairying. Good cows are found in all breeds, and among those of no particular breed, but they are more common among what are known as dairy breeds. I will try to explain the desirable and undesirable points of a dairy cow.

It must be remembered that it is much more difficult to point out the indications of a good dairy cow than it is to point out the indications of a

good beef animal. The reason for this is, that the making of milk is a mystery, and one of the greatest mysteries of Nature, and there is no one outward infallible sign of a cow's ability to produce milk. There are many men who claim to know such a sign; but I must confess at the outset, that I have never yet been able to discover one that can be relied upon in all cases.

In order to make this paper as simple as possible, I shall commence at the front of the animal, and go back, pointing out briefly the good and bad points of a dairy cow.

Head.—In the case of a dairy cow we prefer that the head should be lean and clean cut. There should be no superfluous muscle or meat about it. There should be a good width of nostril to indicate good breathing and the lung power of the animal. The lips should be strong, with a good blunt muzzle.

Eye.—The eye should be bright, of good size, and prominent. The reason I like a prominent eye is, that it is the indication of an animal that makes good use of its food, while an animal with a sunken eye is lacking in this respect, and has a weak constitution; also, a prominent bright eye indicates the nervous power of a dairy cow.

Horn.—The horn should be fine compared with the size of the cow; a spiky horn is an indication of coarseness. The ears should be of moderate size, and not coarse.

Neck.—The neck shonld be long and slender—not too thick or too beefy. A short, thick neck denotes that the animal will lay on beef; it also shows ruggedness of constitution, such as we find in a beef animal. The opposite is true to the dairy cow. The outward conformation, when rightly understood, is a sure indication whether the animal will lay its food on its back or put it in the pail. We require a long slim neck, but I like to see style in the manner the animal carries its head. To my mind, everything that is right in the beef animal is wrong in the dairy animal.

Shoulder.—The top of the shoulder should be pointed. This is a good point, if the sharpness is got by the backbone rising above the shoulder blades, and not by the shoulder blades themselves. The majority of our best dairy cows have the backbone clearly defined, standing above the shoulder blades. A dairy cow should not have a large brisket, but should have plenty of room for the heart and lungs, indicating a good constitution, and plenty of vitality.

Barrel.—Coming back to the barrel, it should have the capacity to contain and assimilate large quantities of food.

Ribs.—The rib bones of the dairy cow should be flat, not round as we often find in a beef animal. There should be as much space as possible between the ribs. Speaking generally, the best dairy cows are of a loose conformation, and the distance from the last rib to the hip bones should be such as to indicate plenty of room for the stomach. I like a broad, deep rib much better than a round well-sprung rib. What is termed round, well-sprung ribs often carry a round barrel or middle piece; still, a cow falling in behind

the shoulders shows want of constitution and small heart and lung development. This must not be confounded with a broad, deep rib. I prefer heart and lung development to be gained by depth of rib rather than by roundness.

Backbone.—The backbone should be prominent. The reason we like a prominent backbone is, that the nervous force generated in the brain is carried back to the udder along the spinal column. A prominent backbone indicates strong development of nervous force which is being sent to the udder to produce milk.

Loin.—The loin should be strong, so that the cow will have strength to carry her calf and large quantities of food, and maintain her formation until she reaches old age.

Hips.—The hips, or "hook" bones, should be prominent, and she should have good length of quarter. The pelvic arch should be prominent. The pin bones should be a good distance apart, giving room for easy parturition.

Flank.—The flank should be arched, indicating plenty of room for the cow's udder. I do not like a deep flank, such as we find in a fat steer. If you look over your cows you will find your best cows have high arched flanks.

Limbs.—The limbs should be in proportion to the animal's size, but we do not require too much development of bone. There should be great width between the hind legs, giving room to the udder.

Udder.—I now come to what should be considered one of the most important points in the dairy cow. One of the rules of a horseman is, "No foot no horse." My rule in judging a dairy cow is, "No udder no cow." If there is one thing more than another that indicates the dairy qualities of a cow, it is the udder. Personally I lay great stress on a good head, neck, and shoulders, but I lay more stress upon a good constitution, and upon the size of the middle piece, indicating the capacity of the cow to use food; but more important still is the development of the cow's udder and the organs connected with it. You will see a great many cows in which the fore-quarters are deficient. If you examine a large number of cows you will not find many with equal development in the front and hind quarters. The question has often been asked,—Why are so many cows deficient in this respect? The explanation is, that the arteries supplying the blood enter the udder in the posterior quarters; consequently more blood comes into that part and is built up more rapidly. While a cow may not have a perfect udder, she may have a good udder, and her milk veins may be quite prominent; and this is a very important sign, as it is an indication of a large amount of blood in connection with the udder. The veins are forced to the outside under the skin, and it is a strong indication of milk-producing qualities. The udder should be covered with soft skin, the hair not coarse or long, and the teats of good size.

Milk veins.—What are commonly called milk-veins coming forward from the cow's udder, should be of good size, and more or less twisted—not running straight. The blood passes from the udder to the heart and lungs to be purified; hence the size of the veins are not due to milk within, but to the impure or venous blood, which indicates the amount of blood that comes into the cow's udder

Milk.—Milk is the product of nervous force applied to the blood in the udder in some mysterious way which no man has been able to explain. This nervous force in the dairy cow is applied to the blood, and it is changed into milk; hence the value of the bright eye and the high spinal column.

Hair.—The hair should be fine, soft, and furry in character. The reason of this is, that in order to have hair of good quality, it must be well supplied with blood. This indicates a good heart and circulation, which means a good constitution, with good feeding qualities and perfect health. It is a sure sign that a cow is not in good health when the hair is staring and turned the wrong way. If anything is wrong with the digestion and circulation the hair is improperly nourished, and we have a hair that is dry and turned the wrong way.

Skin.—As regards the skin, it should be soft but not too thin and papery, still not of the mellowness of a fat steer, but something between both, but not harsh, thick, and dry. The colour of the skin is said by many to be an indication of the richness of the milk. This is not to be relied upon. The colour of the skin denotes the colour of the milk and the butter. A cow with a yellow nankeen skin will generally yield yellow milk and yellow butter, if not spoiled in the making; but it is no true indication of the percentage of butter-fat, as a white milk may be rich in butter-fat. I believe a skin covered with fine scales of a fatty nature is a fair indication of rich milk.

Tail.—Some judges lay great stress on the length of tail as an indication of milking qualities. It should reach the hock and have a good switch. Still, I have seen good cows where the tail did not reach within two inches of the hock. I think a long slender tail denotes a consistent milker.

Escutcheon.—The escutcheon commences from the middle of the four teats, a part of its hair extending forward under the belly in the direction of the navel, while the other part, beginning a little above the houghs, spreads as far as the middle of the hind surface of the thighs, ascending on the udder and, in some classes, running as high as the top of the vulva. The escutcheon is distinguished by its upward growing hair, which takes a direction opposite to that which covers other parts of the skin. The hair of the escutcheon is also distinguished by its tint, which is duller than that of the other hair. The form indicates the class to which it belongs, while the extent of the surface covered denotes the milk-giving capacity. The fineness of the hair and the colour of the skin must be taken into consideration, as cows which have large escutcheons and composed of fine hair are the best milkers, especially if the skin is a yellowish colour with scales of a fatty substance. Cows which have the skin of the escutcheon covered with long coarse hairs of a flaring character will give poor milk, while cows whose udders are covered with short, furry, and velvety hair will generally yield rich milk.

The Chairman called for criticisms.

Mr. Williamson, of Toolijooa, said he had seen more milk taken from the fat Shorthorn of beef strain, on the Lachlan, than from the local milking Shorthorns.

Mr. Quirk said that originally the beef and milking Shorthorn were one and the same. The evolution of the milking Shorthorn was merely the

result of careful culling, and breeding only from milking parents. The characteristics of the two classes were different in many respects. The milking Shorthorns are longer in the head, flatter in the horn, less brisket, finer on the point of the shoulder, higher spinal column, more incurved hips, flatter in the thighs, less muscle, more room between the hind legs when viewed from behind, larger escutcheon, testicles not twisted, larger false milk veins, and much less bone development than the beef Shorthorn.

Mr. Gall asked how could it be profitable to keep an old sire and an old cow?

Mr. Quirk said he only advocated the keeping for stud purposes of vigorous stock as long as they were in full profit.

Mr. Blow said it would not pay to keep old beasts merely for breeding purposes.

Mr. Gall asked as to inbreeding.

Mr. Quirk said the foundation of the great herds was the result of inbreeding, as illustrated in the Booth, Bates, and Cruickshank herds.

Mr. Lindley asked was not Jamie of Oakbank an instance of inbreeding?

Mr. Morton asked why the Guernsey-Shorthorn cross was to be preferred to the Jersey-Shorthorn?

Mr. Quirk said Mr. Hyam was crossing Jersey-Ayrshires. He thought the Guernsey was the more typical dairy beast. The Jersey-Shorthorn crosses became too fine and weedy to be persisted in after a time. The first and second crosses were good. The best cow in England was a Guernsey-Shorthorn cow "Nancy." The great American cow "Yeksa Belle 14351" is a Guernsey; she yielded 10,232 lb. milk producing 700 lb. commercial butter in twelve months. This speaks volumes for the Guernseys and their cross with Shorthorns. By using the Guernsey, you could keep up the size and substance longer.

Mr. W. Thompson thought the remarks of Mr. Quirk were most unfounded regarding telegony, and they were the only weak spot in the lecture. These freaks were due to heredity.

Mr. Quirk said it was difficult to prove, but all horse-masters recognised it, and instanced the opinion of the late Hon. James White, one of our most astute and successful race-horse breeders. He said, "If a blood mare was served by a cross-bred horse and she produced a foal, it took three foals to get it out of her system, if you ever did; and although a horse may appear pure bred, you will find out at the end of a hard-fought mile when the whips are out there is other than pure blood in his veins, the effect of telegony."

The Chairman supported this view, and gave instances of it.

Mr. Lindley said Sidney, the great authority on swine, also held the view of Mr. Quirk.

Captain Blow held that the lecturer was wrong in arguing that milk (butter-fat) in any cow could not be increased by overfeeding.

Mr. Quirk said you could not feed butter-fat into a cow. There was a certain maximum of butter-fat, beyond which a cow would not produce. Experiments showed that while you could artificially force up the quantity, you could not force up the quality by feeding.

Mr. W. Thompson asked for points as to how dairy bulls should be judged at shows. He thought it was generally a failure.

Mr. Quirk thought it was desirable for competent dairy stock judges to explain at shows the points of the animals before them in the ring. It was difficult to describe these matters without a model in front of us. (The different points were explained at length.)

Mr. Thompson said if a bull had a good head and neck, and good pair of hips, he was good enough.

The Chairman said in time to come the societies must give a prize for a "bull and his progeny" in every section and class.

Mr. Thompson held that a bull, without being coarse, should be masculine and bull-like.

Mr. Gall asked whether a flat rib was preferable to a round rib?

Mr. Quirk advocated depth of barrel rather than roundness.

Mr. John Strong inquired whether, by adhering to the milking Shorthorns for a term of years, would there be a danger of their becoming too coarse.

Mr. Quirk thought not. There was very little risk of their getting back to the characteristics of the beef Shorthorns, as we call upon them to produce milk and calves at an early age.

In reply to Mr. Osborne, the lecturer said no precise age could be fixed for beginning to breed from a heifer. It was largely a question of constitution. The Jerseys had proved their quality all over the globe, and it was a pity they are not bred on the large side.

Mr. Thompson said it was all the pastures that kept the cattle weedy.

Mr. Gall said you required to kill the constitution to avoid coarseness and beefiness.

Mr. Leslie asked what was the prejudice against white cows?

Mr. Quirk said there was very little in colour, though white teats scalded quickly.

Mr. Rudd said he read of cows whose test had improved from 3·7 to 5·1, by transferring them from bush grass to *paspalum*.

Mr. Lindley thought the objection to white cattle was their susceptibility to cancerous complaints.

Mr. Thompson said a white cow was as fond of a hot sun as any other colour.

In reply to Mr. Price, Mr. Quirk said he should consider the nature of the country before he selected his particular breed.

The Chairman said the two lectures given showed how wise the Government were to make this stipulation with regard to the subsidy.

Captain Blow moved a vote of thanks, and said Mr. Quirk deserved the utmost credit for his exertions.

Mr. W. Thompson seconded, and said he was agreeably surprised at the treat given by Mr. Quirk after the "tommy rot" we sometimes hear at public meetings.

Mr. Quirk expressed the hope that others present would read papers.

A vote of thanks to the Chairman closed the proceedings.

Hawkesbury Agricultural College and Experimental Farm.

Potato Experiments.

GEORGE MARKS,
Instructor of Agriculture, Hawkesbury Agricultural College.

THE experiments with potatoes, carried out during the past season, comprised two main series, viz. :—

Experiments with various fertilisers.

Experiments with different varieties.

The season was not a favourable one for potato-growing in the Hawkesbury district, and, as a consequence, the yields throughout were light. Prices were, however, high, and those who were fortunate to secure fair crops, obtained good returns.

Trials with fertilisers and varieties were conducted in the poor soil on the experimental plots, and also on the rich alluvial flat of the River farm.

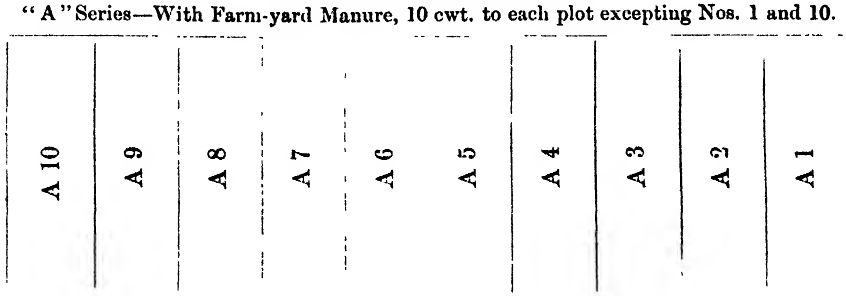
Fertiliser Experiments.

Experimental Plots.

Plot A 6 was selected for this trial. It consists of a light pipeclay loam. The previous crop was cowpea, which was ploughed under green in the autumn. The vines were well decomposed by the time the second ploughing took place in the early spring. Planting took place on 4th September, 1905, and on account of the seed being well sprouted, and the soil in splendid condition, a uniform growth was obtained. The variety selected for this trial was Brownell's Beauty. As a precaution against the introduction of scab, the potatoes were dipped in a solution, consisting of 2 oz. corrosive sublimate to 16 gallons of water, for five minutes, and then spread out to dry. They were then cut into sets containing about two eyes each. Twenty plots, each consisting of $\frac{1}{20}$th of an acre, were planted. The plots were made up of five drills, 2 feet 7 inches apart, and 2½ chains long. The accompanying plan will convey an idea of the arrangement of the plots.

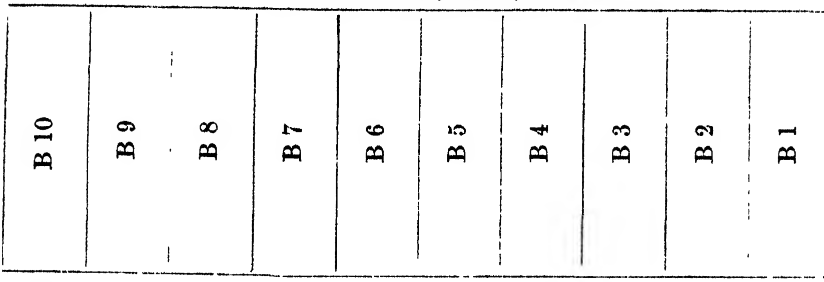
Plan of Manure Experiments.

"A" Series—With Farm-yard Manure, 10 cwt. to each plot excepting Nos. 1 and 10.



B

"B" Series—Without any Farm-yard Manure.



The object of this experiment was to test the effect of commercial fertilisers, with and without the addition of farm-yard manure. "A" section received a dressing of 10 tons to the acre, while "B" section was untreated in this respect. The drills were opened up about 4 inches deep. The chemical fertilisers were spread evenly along these, and the sets planted immediately afterwards. The following table gives the rainfall during the time the crop was growing:—

	inches.
1905.	
September	1·345
October	1·095
November	1·812
December	4·740
1906.	
January	2·310
Total	11·302

Strong westerly winds retarded the growth considerably, and several heat waves seriously interfered with the formation of tubers. The evaporation from the soil surface was great, and for the five months named above, the evaporation from a water surface was 26·711 inches. This meant a constant draining upon the subsoil moisture, but with regular and careful cultivation this was reduced to a minimum.

The results must be considered as those obtained under distinctly droughty conditions. The following tables give the returns. They were harvested on February 6, 1906:—

Manure Experiment with Potatoes.

Variety: Brownell's Beauty. Grown at College.

"A" Series—With addition of Farm-yard Manure.

No. of Plot.	Size of Plot.	Manures used.	Amount per Plot.	Amount per Acre.	Yield of Plot.			Yield per Acre.			
	acre				cwt.	qrs.	lb.	tons	cwt.	qrs.	lb.
1	$\frac{1}{20}$	No manure	......	......	2	1	26	2	9	2	16
2	$\frac{1}{20}$	Farm-yard manure ... .. Superphosphate	10 cwt. 11 lb.	10 tons 2 cwt.	2	3	12	2	17	0	16
3	$\frac{1}{20}$	Farm-yard manure ... .. Sulphate of potash	10 cwt. 5½ lb.	10 tons 1 cwt.	2	3	20	2	18	2	8

Manure Experiment with Potatoes. "A" Series—*continued.*

No. of Plot.	Size of Plot.	Manures used.	Amount per Plot.	Amount per Acre.	Yield of Plot.			Yield per Acre.			
	acre				cwt.	qrs.	lb.	tons	cwt.	qrs.	lb.
4	1/20	Farm-yard manure ... Sulphate of ammonia ...	10 cwt. 4 lb.	10 tons 3/4 cwt.	3	0	20	3	3	2	8
5	1/20	Farm-yard manure ... Superphosphate ... Sulphate of potash ...	10 cwt. 11 lb. 5½ ,,	10 tons 2 cwt. 1 ,,	3	2	0	3	10	0	0
6	1/20	Farm-yard manure ... Superphosphate ... Sulphate of ammonia ..	10 cwt. 11 lb. 4 ,,	10 tons 2 cwt. 3/4 ,,	3	1	0	3	5	0	0
7	1/20	Farm-yard manure ... Sulphate of potash .. Sulphate of ammonia ...	10 cwt. 5½ lb. 4 ,,	10 tons 1 cwt. 3/4 ,,	3	1	13	3	7	1	8
8	1/20	Farm-yard manure ... Superphosphate ... Sulphate of potash ... Sulphate of ammonia ...	10 cwt. 11 lb. 5½ ,, 4 ,,	10 tons 2 cwt. 1 ,, 3/4 ,,	3	2	20	3	13	2	8
9	1/20	Farm-yard manure ...	10 cwt.	10 tons	3	1	25	3	9	1	24
10	1/20	No manure	......	......	2	3	11	2	16	3	24

Manure Experiment with Potatoes.

Variety: Brownell's Beauty. Grown at College.

"B" Series—Without Farm-yard Manure.

No of Plot.	Size of Plot	Manures used.	Amount per Plot.	Amount per Acre	Yield of Plot.			Yield per Acre.			
	acre				cwt.	qrs.	lb.	tons	cwt.	qrs.	lb.
1	1/20	No manure	......	......	2	3	2	2	15	1	12
2	1/20	Superphosphate ...	22 lb.	4 cwt.	2	3	19	2	18	1	16
3	1/20	Sulphate of potash ...	11 lb.	2 cwt.	3	1	3½	3	5	2	14
4	1/20	Sulphate of ammonia .	5½ lb.	1 cwt.	3	0	13½	3	2	1	18
5	1/20	Superphosphate ... Sulphate of potash ...	22 lb. 11 ,,	4 cwt. 2 ,,	3	1	14	3	7	2	0
6	1/20	Superphosphate ... Sulphate of ammonia ..	22 lb. 5½ ,,	4 cwt. 1 ,,	3	0	3	3	0	2	4
7	1/20	Sulphate of potash ... Sulphate of ammonia ...	11 lb. 5½ ,,	2 cwt. 1 ,,	2	2	21	2	13	3	0
8	1/20	Superphosphate ... Sulphate of potash ... Sulphate of ammonia ...	22 lb. 11 ,, 5½ ,,	4 cwt. 2 ,, 1 ,,	3	0	0	3	0	0	0
9	1/20	Superphosphate ... Muriate of potash ... Sulphate of ammonia ...	22 lb. 11 ,, 5½ ,,	4 cwt. 2 ,, 1 ,,	3	1	6	3	6	0	8
10	1/20	No manure	......	......	2	1	2	2	5	1	12

River Farm.

This experiment was carried out with a view of noticing the effect of manures on rich alluvial lands and compare the returns with those on the lighter soils. The same amounts and kinds of manures were used, and the arrangement of the plots was exactly the same as in the former experiment.

Bliss Triumph was the variety planted. The soil was in a good friable condition, but the unfavourable weather conditions affected the growth, as in the previous trial. Planting took place on 24th August, 1905; they were harvested on 14th February. The following tables give the yields:—

Manure Experiment with Potatoes.

Variety: Bliss Triumph. Grown on River Farm.

"A" Series—With addition of Farm-yard Manure.

No. of Plot.	Size of Plot.	Manures used.	Amount per Plot.	Amount per Acre.	Yield of Plot.			Yield per Acre.			
	Acre				cwt.	qr.	lb.	tons	cwt.	qr.	lb.
1	$\frac{1}{20}$	No manure	...	......	4	1	23	4	9	0	12
2	$\frac{1}{20}$	Farm-yard manure .. .. Superphosphate .. .	10 cwt. 11 lb.	10 tons 2 cwt.	5	1	7	5	6	1	0
3	$\frac{1}{20}$	Farm-yard manure ... .. Sulphate of potash	10 cwt. 5½ lb.	10 tons 1 cwt.	5	3	21	5	18	3	0
4	$\frac{1}{20}$	Farm-yard manure ... .. Sulphate of ammonia .	10 cwt. 4 lb.	10 tons ¾ cwt.	6	0	7	6	1	1	0
5	$\frac{1}{20}$	Farm-yard manure ... .. Superphosphate ... ... Sulphate of potash	10 cwt. 11 lb. 5½ ,,	10 tons 2 cwt. 1 ,,	6	0	5	6	0	3	16
6	$\frac{1}{20}$	Farm-yard manure ... ... Superphosphate ... .. Sulphate of ammonia ..	10 cwt. 11 lb. 4 ,,	10 tons 2 cwt. ¾ ,,	6	1	12	6	7	0	16
7	$\frac{1}{20}$	Farm-yard manure ... .. Sulphate of potash ... .. Sulphate of ammonia .	10 cwt. 5½ lb. 4 ,,	10 tons 1 cwt. ¾ ,,	5	2	5	5	10	3	16
8	$\frac{1}{20}$	Farm-yard manure ... ... Superphosphate ... .. Sulphate of potash .. .. Sulphate of ammonia ...	10 cwt. 11 lb. 5½ ,, 4 ,,	10 tons 2 cwt. 1 ,, ¾ ,,	6	0	13	6	2	1	8
9	$\frac{1}{20}$	Farm-yard manure	10 cwt.	10 tons	5	2	19	5	13	1	16
10	$\frac{1}{20}$	No manure	......	......	4	2	20	4	13	2	8

Manure Experiment with Potatoes.

Variety : Bliss Triumph. Grown on River Farm.

"B" Series—Without Farm-yard Manure.

No. of Plot.	Size of Plot.	Manures used.	Amount per Plot.	Amount per Acre.	Yield of Plot.			Yield per Acre.			
	Acre.				cwt.	qr.	lb.	tons	cwt.	qr.	lb.
1	1/20	No manure	......	......	3	3	1	3	15	0	20
2	1/20	Superphosphate	22 lb.	4 cwt.	4	0	14	4	2	2	0
3	1/20	Sulphate of potash	11 lb.	2 cwt.	4	1	22	4	8	3	20
4	1/20	Sulphate of ammonia ..	5½ lb.	1 cwt.	4	1	7	4	6	1	0
5	1/20	Superphosphate ... ... Sulphate of potash ...	22 lb. 11 lb.	4 cwt 2 ,,	5	0	6	5	1	0	8
6	1/20	Superphosphate .. .. Sulphate of ammonia .	22 lb. 5½ lb.	4 cwt. 1 ,,	5	1	13	5	7	1	8
7	1/20	Sulphate of potash .. . Sulphate of ammonia .	11 lb. 5½ lb.	2 cwt. 1 ,,	4	3	9	4	16	2	12
8	1/20	Superphosphate .. .. Sulphate of potash ... ... Sulphate of ammonia ..	22 lb. 11 lb. 5½ lb.	4 cwt. 2 ,, 1 ,,	5	1	27	5	9	3	8
9	1/20	Superphosphate ... .. Muriate of potash . .. Sulphate of ammonia .	22 lb. 11 lb. 5½ lb.	4 cwt. 2 ,, 1 ,,	5	0	22	5	3	3	20
10	1/20	Unmanured	... ..	.. ...	4	0	6	4	1	0	8

Cost of the Fertilisers.

Since the object of manure experiments is to find out which will increase the yields, it is essential to know not only the cost of producing the crop, but also of the fertilisers used, in order that the profits may be estimated. Experiments of this kind always entail a great deal of time and labour—careful laying-out and measurements of plots, weighing, mixing, and sowing the various kinds of manures, harvesting and weighing the crop, tabulating the yields, &c.—but the grower who takes advantage of these is able to select those manures which give the best returns, and to him the cost would be only

the price of the fertilisers and the labour required to sow these. Though wages vary slightly in different districts, the following may be taken as a guide to the cost of producing an acre of potatoes yielding 4 tons:—

	£	s.	d.
First ploughing	0	10	0
Second "	0	9	0
Harrowing four times	0	3	0
Rolling twice	0	1	0
Drilling	0	1	0
Seed, 8 cwt. at 9s.	3	12	0
Cutting	0	2	6
Planting	0	12	0
Cultivating four times	0	4	0
Digging and bagging (4-ton crop)	2	8	0
Four dozen bags (second-hand)	0	18	0
Loading and carting—say, one mile	0	6	0
	£9	6	6
Four tons of potatoes at £8	32	0	0
Cost of production...	9	6	6
Net return	£22	13	6

With regard to the cost of applying farm-yard manure, there are several factors to be considered, one of the chief being the distance the manure has to be carted. For drawing half a mile the cost may be put down at anything from 15s. to £1 per acre. Where it has to be purchased, the price would have to be added to the above.

The purchase of bags is rather an important item. New bags cost from 7s. to 8s. per dozen, while good second-hand ones can usually be obtained for about 4s. 6d., meaning a difference of 10s. to 14s. on a 4-ton crop. When heavier yields are obtained, the amounts would be much greater per acre.

Since second-hand bags may be a means of introducing scab or other diseases to a farm, it would be well to fumigate, or treat them in some way, so as to prevent the possibility of spreading any disease.

New bags, though costing more, are safe and free from this trouble, and where potatoes have to stand long journeys in reaching a market it might be found advisable to use them.

The crops this season were light, consequently the cost of digging and bagging (1s. per bag) is higher than usual. Though the yields were only about half those obtained in an ordinary good season the prices were high, and at the time of harvesting ranged from £8 to £8 10s. per ton.

The chemical fertilisers were gratuitously supplied by Mr. Hattrick, of the Agricultural Offices of the Potash Syndicate. The prices of those used are as follows in Sydney:—

Superphosphate	£4	5s.	per ton.
Sulphate of potash	£13	10s.	„
Muriate of potash	£13	10s.	„
Sulphate of ammonia	£14	10s.	„

The yield of the "no manure" plots in each series varied somewhat, but it is interesting to note that, without exception, they were all much lower than those that were manured, and to obtain a fair weight from which to make the comparison each series was averaged.

It was evident from the general appearance of the crop, and the dryness of the soil during the greater portion of the time the ground was occupied, that the whole of the manures were not utilised, and it must be remembered that unless there is sufficient moisture present to render soluble the ingredients in the manures required by the plants, increased returns cannot be expected.

The value of farm-yard manure cannot be too strongly impressed upon agriculturists, for to them it costs nothing but the saving and its application. Throughout the whole of the experiments this manure gave increased returns. On the poor soil at the College 16 cwt. to the acre was obtained, whilst on the rich alluvial soil on the River farm 22 cwt. was returned in excess of that from the unmanured plots. Unfortunately a number of potatoes in Plot No. 7, Series B, in the experimental plots failed to sprout, which undoubtedly accounted for the low returns. It is not always easy to obtain a uniform growth over an extended area; there are usually differences in the nature of the soil, vitality of the seed, &c, each of which seriously interferes with the yields. By having check plots and averaging them in the manner before described, the resulting weights may be looked upon as being fairly representative of the whole area.

In the attached tables are given the increase, value of increase, and profits due to the use of the fertilisers.

While not placing too much reliance on the returns obtained in a single season and under adverse weather conditions, the results seem to indicate that to the intelligent grower who studies the nature of his soil and the requirements of his crop, the application of suitable fertilisers, even though they may cost up to £2, or possibly more, per acre, will give him increased profits. When applying these they should be used for feeding the crop, not the soil. As these vary greatly in different localities, the only reliable way to test the efficacy of the various fertilisers is to conduct experiments on lines somewhat similar to those just described, not for one crop only, but continuously for a number of years. At the end of a few seasons the results may be examined, when fairly reliable comparisons can be made, and those manures which give the greatest profits utilised for sowing on much larger areas.

TABLE showing value of increased yields at £8 per ton and cost of Manures used in Experiment on the Experimental Plots.

"A" Series—With Farm-yard Manure.

No of Plot.	Kind and Quantities of Manures per acre.	Cost per acre.	Yield per acre.	Increase per acre over Unmanured plots	Value of increase per acre.	Profit per acre due to Manure.
		£ s d.	ton cwt. qr. lb	ton cwt. qr. lb.	£ s. d.	£ s. d.
1	*No Manure	.....	2 13 1 6	... .	......	......
2	2 cwt. Superphosphate .. .. 10 tons Farm-yard Manure.	0 8 6	2 17 0 16	0 3 3 10	1 10 8	1 2 2
3	1 cwt. Sulphate of Potash . 10 tons Farm-yard Manure.	0 13 6	2 18 2 8	0 5 1 2	2 2 1	1 8 7
4	¾ cwt. Sulphate of Ammonia .. 10 tons Farm yard Manure.	0 10 10½	3 3 2 8	0 10 1 2	4 2 1	3 11 2½
5	2 cwt. Superphosphate .. .. 1 ,, Sulphate of Potash. 10 tons Farm-yard Manure.	1 2 0	3 10 0 0	0 16 2 22	6 13 6	5 11 6
6	2 cwt. Superphosphate .. .. ¾ ,, Sulphate of Ammonia. 10 tons Farm-yard Manure	0 19 4½	8 5 0 0	0 11 2 22	4 13 6	3 1 14½
7	1 cwt. Sulphate of Potash .. ¾ ,, Sulphate of Ammonia. 10 tons Farm-yard Manure.	1 4 4½	3 7 1 8	0 14 0 2	5 12 1	4 7 8½
8	2 cwt. Superphosphate .. .. 1 ,, Sulphate of Potash. ¾ ,, Sulphate of Ammonia. 10 tons Farm-yard Manure.	1 12 10½	3 13 2 8	1 0 1 2	8 2 1	6 9 2½
9	10 tons Farm-yard Manure . ..	. . .	3 9 1 24	0 16 0 18	6 9 3	.....
10	*No Manure	......	2 13 1 1	....	.....	......

* Average of Plots A 1 and A 10—2 tons 13 cwt. 1 qr. 6 lb.

"B" Series—Without Farm-yard Manure.

No. of Plot.	Kind and Quantities of Manures per acre.	Cost per acre.	Yield per acre.	Increase per acre over Unmanured plots.	Value of increase per acre.	Profit per acre due to Manure.
		£ s. d.	ton cwt. qr. lb.	ton cwt. qr. lb.	£ s. d	£ s. d.
1	*No Manure	......	2 10 1 12	.... .	....	......
2	4 cwt. Superphosphate	0 17 0	2 18 1 16	0 8 0 4	3 4 3	2 7 3
3	2 cwt. Sulphate of Potash ..	1 7 0	3 5 2 14	0 15 1 2	6 2 1	4 15 1
4	1 cwt Sulphate of Ammonia .	0 14 6	3 2 1 18	0 12 0 6	4 16 5	4 1 11
5	4 cwt. Superphosphate .. .. 2 ,, Sulphate of Potash.	2 4 0	3 7 2 0	0 17 0 16	6 17 1	4 13 1
6	4 cwt. Superphosphate .. .. 1 ,, Sulphate of Ammonia.	1 11 6	3 0 2 4	0 10 0 20	4 1 5	2 9 11
7	2 cwt Sulphate of Potash .. .. 1 cwt. Sulphate of Ammonia.	2 1 0	2 13 3 0	0 3 1 16	1 7 1	......
8	4 cwt. Superphosphate .. .. 2 ,, Sulphate of Potash. 1 ,, Sulphate of Ammonia.	2 18 6	3 0 0 0	0 9 2 16	3 17 1	0 18 7
9	4 cwt. Superphosphate .. .. 2 ,, Muriate of Potash. 1 ,, Sulphate of Ammonia.	2 18 6	3 6 0 8	0 15 2 24	6 5 8	3 7 2
10	*No Manure	......	2 10 1 12	....	......	......

*Average yield of B 1 and B 10—2 tons 10 cwt. 1 qr. 12 lb.

Cost of Manures used in Experiment on the River Farm.

"A" Series—With Farm-yard Manure.

No. of Plot.	Kinds and Quantities of Manure per acre.	Cost per acre.	Yield per acre.	Increase per acre over Unmanured Plot.	Value of Increase per acre.	Profit per acre due to Manure.
		£ s. d.	tons cwt. qrs. lb.	tons cwt. qrs. lb.	£ s. d.	£ s. d.
1	*No Manure	......	4 11 1 15	....	......	......
2	2 cwt. Superphosphate .. .. 10 tons Farm-yard Manure.	0 8 6	5 6 1 0	0 14 3 13	5 18 11	5 15 0
3	1 cwt. Sulphate of Potash .. 10 tons Farm-yard Manure.	0 13 6	5 18 3 0	1 7 1 13	10 18 11	10 5 5
4	¾ cwt. Sulphate of Ammonia, . 10 tons Farm-yard Manure.	0 10 10½	6 1 1 0	1 9 3 13	11 18 11	11 8 0½
5	2 cwt. Superphosphate .. .. 1 ,, Sulphate of Potash. .. 10 tons Farm-yard Manure.	1 2 0	6 0 3 16	1 9 2 1	11 16 0	10 14 0
6	2 cwt. Superphosphate .. . ¾ ,, Sulphate of Ammonia 10 tons Farm-yard Manure.	0 19 4½	6 7 0 16	1 15 3 1	14 6 0	13 6 7½
7	1 cwt. Sulphate of Potash . ¾ ,, Sulphate of Ammonia. 10 tons Farm-yard Manure.	1 4 4½	5 10 3 16	0 19 2 1	7 16 0	6 11 7½
8	2 cwt. Superphosphate .. . 1 ,, Sulphate of Potash. ¾ ,, Sulphate of Ammonia. 10 tons Farm-yard Manure.	1 12 10½	6 2 1 8	1 10 3 21	12 7 6	10 14 7½
9	10 tons Farm-yard Manure . .	.....	5 13 1 16	1 2 0 1	8 16 0	. .
10	*No Manure	...	4 11 1 15	....	.....	. ...

* Average of Plots A 1 and A 10 4 tons 11 cwt. 1 qr. 15 lb.

"B" Series—Without Farm-yard Manure.

No. of Plot.	Kinds and Quantities of Manure per acre.	Cost per acre.	Yield per acre.	Increase per acre over Unmanured Plot.	Value of Increase per acre.	Profit per acre due to Manure.
		£ s. d.	tons cwt. qrs. lb.	tons cwt. qrs. lb.	£ s. d.	£ s. d.
1	*No Manure	......	3 18 0 14	.. . .	.....	. ...
2	4 cwt. Superphosphate	0 17 0	4 2 2 0	0 4 1 14	1 15 0	0 18 0
3	2 cwt. Sulphate of Potash.. ..	1 7 0	4 8 3 20	0 10 3 6	4 6 10	2 19 10
4	1 cwt. Sulphate of Ammonia ..	0 14 6	4 6 1 0	0 8 0 14	3 5 0	2 10 6
5	4 cwt. Superphosphate .. .. 2 ,, Sulphate of Potash.	2 4 0	5 1 0 8	1 2 3 22	9 3 6	6 19 6
6	4 cwt. Superphosphate .. .. 1 ,, Sulphate of Ammonia.	1 11 6	5 7 1 8	1 9 0 22	11 13 6	10 2 0
7	2 cwt. Sulphate of Potash .. 1 ,, Sulphate of Ammonia.	2 1 0	4 16 2 12	0 18 1 26	7 7 10	5 6 10
8	4 cwt. Superphosphate .. .. 2 ,, Sulphate of Potash. 1 ,, Sulphate of Ammonia.	2 18 6	5 9 3 8	1 11 2 22	12 13 6	9 15 0
9	4 cwt. Superphosphate .. .. 2 ,, Muriate of Potash. 1 ,, Sulphate of Ammonia.	2 18 6	5 3 3 20	1 5 3 6	10 6 5	7 7 11
10	*No Manure	......	3 18 0 14	....	......	.. ..

* Average of Plots B 1 and B 10—3 tons 18 cwt. 0 qr. 14 lb.

Variety Trials.

Twenty-seven varieties were selected for these trials. They were grown in well-prepared soil at the College, and on the alluvial soil on the River farm. No artificial fertiliser was used. The soil in both places was similar to that selected for the fertiliser trials. The planting was, however, a fortnight later, and the varieties suffered severely from the weather, in fact quite a number were simply killed off by the heat, accounting in a great measure for the low yields obtained. It is interesting to note the differences in yield. Up-to-date,—a white potato—gave the highest yield, with Centennial, a fine red skin variety, second. They were harvested on 12th February, 1906.

The following tables show the yields :—

Variety Trial, Experimental Plots.

			Per acre.			
	qrs.	lb.	tons	cwt.	qrs.	lb.
Early Rose	0	11½	1	2	2	10
Satisfaction	0	6	0	11	3	4
Imperator	0	17	1	13	1	16
Anderson's A1 ...	0	6	0	11	3	4
Irish Flounder ...	0	10	0	19	2	16
Cambridge Kidney ...	0	5	0	9	3	8
Aroostook County Prize.	0	7	0	13	3	0
Early Northern ...	0	5	0	9	3	8
Adirondack	0	7	0	13	3	0
Green Mountain ...	0	9½	0	18	2	18
Red Russet	0	9	0	17	2	20
Centennial	0	12¼	1	4	2	6
Sutton's Early Regent	0	29	2	16	3	24
Royalty	0	4	0	7	3	12
Early Puritan ...	0	15	1	9	1	24
Dakota Red	0	14	1	7	2	0
Snowdrop	0	2	0	3	3	20
Ruby	0	10	0	19	2	16
Breeze's Peerless ...	0	10	0	19	2	16
Red Skin	0	6	0	11	3	4
Carmen No. 1 ...	0	14	1	7	2	0
Up-to-Date	0	22½	2	4	0	22
Australian Monarch...	0	1½	....			
Hero	0	7	0	13	3	0
Beauty of Hebron ...	0	15	1	9	1	24
Northern Star ...	0	14	1	7	2	0
Robin Adair	0	7	0	13	3	0

Variety Trial, River Farm.

			Per acre.			
	qrs.	lb.	tons	cwt.	qrs.	lb.
Early Rose	1	0	2	15	0	0
Satisfaction	1	2	2	18	3	20
Imperator	1	5	3	4	3	8
Anderson's A1 ...	0	17	1	13	1	16
Irish Flounder ...	1	0	2	15	0	0
Cambridge Kidney ...	1	6	3	6	3	4
Aroostook County Prize.	0	23	2	5	0	20
Early Northern ..	0	7	0	13	3	0
Adirondack	0	27	2	13	0	4
Green Mountain ..	1	7	3	8	3	0
Red Russet	1	0	2	15	0	0
Centennial	1	8	3	10	2	24
Sutton's Early Regent	0	12	1	3	2	8
Royalty	0	20	1	19	1	4
Early Puritan ...	0	26	2	11	0	8
Dakota Red	0	15	1	9	1	24
Snowdrop	0	9¼	0	18	2	18
Ruby	0	7½	0	14	2	26
Breeze's Peerless ...	0	22½	2	4	0	22
Red Skin	0	10	0	19	2	16
Carmen No. 1 ...	0	17	1	13	1	16
Up-to-date	1	10	3	14	2	16
Australian Monarch...	0	18	1	15	1	12
Hero	0	18¼	1	15	3	11
Beauty of Hebron ...	0	15¼	1	9	3	23
Northern Star ...	0	21¼	2	1	2	27
Robin Adair	0	8	0	15	2	24

The Northern Star Potato.

This variety has been grown continuously for the past two seasons. The results of these experiments prove the unsuitability of this potato for this district under what may be termed droughty conditions. Each plant produces large numbers of tubers, but they are not fully developed when the plant ripens off. If it were able to grow each tuber to a marketable size, this variety would be an enormous cropper, but our climatic conditions do not suit it.

The Gem of the South Potato.

A single tuber of this potato was forwarded by Mr. Russell Kidd, of Invermay, Tasmania. It was cut into 18 sets of one eye each, and planted in well-prepared soil on the 20th September. The young plants appeared above the surface towards the middle of October. They grew vigorously till the heat waves of December and January came along, when they went completely off. When the tops had died, the tubers were lifted, 112 in number, weighing 10 lb. It is evidently a late variety, as all the tubers were small and not properly matured. Although it would take a season or two to properly acclimatise a new variety, it would appear that this potato, which evidently thrives well in Tasmania, is not suitable for growing in our hot and dry districts.

Potato Experiments carried out by Mr. A. C. Hannabus, on his Farm at Windsor.

In 1904, Mr. Hannabus obtained from the College a number of varieties of potatoes for trial on his rich alluvial soil. Dry weather seriously interfered with the results, but another trial was carried out during the past season, together with some of his own sorts, as Red Rock, Early Manhattan, Circular Head, and Brownell's Beauty. Manure at the rate of about $2\frac{1}{2}$ cwt. to the acre was used of the following: Superphosphate, 4 parts; Sulphate of Potash, 2 parts; and Sulphate of Ammonia, 1 part. They were sown on the 29th September, 1905, in well-prepared land in drills 2 ft. 9 in. apart, and the sets sprouted evenly. They experienced similar weather conditions to those grown at the College, the rainfall from September to January being as follows:—

September	1·387	December	3·964
October	1·086	January	2·273
November	1·025		
		Total	9·735

These figures were supplied by Mr. John Tebbutt, of The Peninsula, Windsor. Some of the varieties were completely killed off by the heat, which probably accounts for their low yields. The potatoes were lifted on the 30th and 31st January, 1906, and portion of a drill one chain long was weighed for estimating the yields.

The following table gives the returns:—

VARIETY TRIAL carried out at Windsor by Mr. A. C. HANNABUS.

Name.	Yield of Plot.		Yield per Acre.				Remarks.
	qrs.	lb.	tons	cwt.	qrs.	lb.	
Red Rock	1	15½	4	13	0	24	Late; not suitable for dry season.
Beauty of Hebron	1	22	5	7	0	16	Good cropper, but does not keep well in hot ground.
Carmen No. 1	1	14	4	10	0	0	Suitable to district.
Avoca	1	0¾	3	1	2	12	Further trials necessary.
Bliss Triumph (a)	0	10	1	1	1	20	Badly attacked by bugs.
Australian Monarch	0	10	1	1	1	20	Not suitable to district.
Early Rose (local seed)	0	19	2	0	2	24	,, ,,
Pride of the South	1	5½	3	11	3	4	Worthy of another trial.
Bliss Triumph (b)	0	15	1	12	0	16	Badly attacked by bugs.
Sutton's Early Regent	1	9½	4	0	1	12	Good sort.
Green Mountain	1	2	3	4	1	4	Requires further trials.
Early Rose (from imported seed) ...	1	11¼	4	4	0	12	Promising variety.
Up-to-Date	0	17¾	1	18	0	4	Unsuitable.
Northern Star	0	13	1	7	3	12	,,
Dakota Red	0	18	1	18	2	8	Requires further trials.
Aerial Rose	1	9	3	19	1	4	,, ,,
Monarch	1	20	5	2	3	12	Suitable variety.
Aroostook Co. Prize	1	18¼	4	19	0	12	Requires further trial.
Brownell's Beauty	1	17	4	16	1	20	One of the best; splendid shape and quality.
Early Manhattan	1	10½	4	2	2	0	Suitable to district; good keeper and cropper.
Circular Head	0	20½	2	3	3	20	Quality good; tubers smooth.
Early Northern	0	4½	0	9	2	16	Unsuitable.

Although the season was unfavourable, a number of those grown are evidently unsuitable for growing under dry conditions. Mr. Hannabus considers that the true Brownell and the Manhattan are the two best for general purposes. They produce large, well-shaped tubers that command ready sale and keep well. They withstand the effects of heat and drought, and are not so subject to second growth as many others are when the season is unfavourable. He also finds that the Northern Star potato is unsuitable; it produces a number of small tubers, of little value for market purposes. Mr. Hannabus is to be commended for the time and trouble he has gone to in connection with the above experiment, the whole of which has been conducted under what may be termed distinctly farmers' conditions.

Artesian Irrigation.

[Continued from page 588.]

W. R. FRY,
Manager, Moree Experimental Farm.

II.

Application of Water.

In the actual application of water to the crop, some practical and local experience is necessary to obtain best results. The method generally employed is to block up the main channel by timber weirs, bags of soil, heaps of manure, or canvas dams, and thus direct part of the stream into a head drain which runs at right angles to the irrigating furrows. These furrows are made with a two-horse cultivator, by removing the tines and attaching one shovel or double-winged tine to the centre; a double mould-board plough can also be used for this purpose, or a special wooden implement to make two furrows each turn.

The length of these furrows and their distance apart depends on the kind of soil and condition. If newly-ploughed clay soil, from 8 to 10 feet apart is the best distance, and a small stream, running slowly, will easily soak 5 feet on either side; but if the ground is not ploughed it will not spread very far in a lateral direction, unless the soil be very dry and cracked. The length of furrow depends on the fall of the ground. If the slope is gradual and equal to 1 foot fall in 10 chains, the furrows can be that length; but if the furrows are across the slope, or land nearly level, they should not be more than 100 yards long. An escape drain or tail-race, slightly deeper than the furrows, is made across the end, and the water is cut off as soon as it has soaked within a yard or so of the end; the back-water by seepage then moistens the remainder, and any excess runs off to the next plot.

To divide a given quantity of water evenly between each furrow requires a certain amount of skill and attention, as if the water is allowed to run for an hour or more without attention, the soil washes away, one furrow robs the other, and the distribution becomes unequal. If, say, twelve furrows are to receive water first, an old bag is placed about half way down the head drain to retain sufficient head of water to supply the first six furrows, and the same amount of water is allowed to flow over; another check is placed below this to give sufficient water for four more

furrows, and below this the drain is temporarily blocked altogether with earth, to supply the last two furrows. If the water in some furrows reaches the end before the others, they are cut off until the whole of the first section is effectively soaked, then the temporary obstructions are removed from the head drain, and the process repeated on the next section. Care must be taken not to rush too big a stream of water through the furrows at first, or they will become puddled and not soak well. It is also not advisable to cut the water off at night if it can be avoided, as much of the same ground will have to be watered over again, which is injurious to the soil and wasteful of water. When attention cannot be given, as at night-time, the use of short lengths of pipes or sluice-boxes at the entrance to each furrow are very convenient, and, by preventing scouring, ensure an even supply. The water should soak through the ground by furrows, and never flood over it, the aim being to get the water into the soil, not on to it. Although these remarks are written more especially with regard to irrigation with bore-water, most of them will also apply to irrigation from other means of supply.

The Duty of Water.

An idea of the duty of water, or the greatest area that can be effectively irrigated from a given flow, is of great importance, but so many different matters have to be considered that no hard-and-fast rule can be laid down. The annual rainfall, the summer temperature and evaporation, the condition of the soil, and the kind of crop grown are factors which cause great variation in this matter.

The total area irrigated from the Moree Bore is only about 200 acres; but as the public baths, woolscour, and other places use a good deal of the water, no accurate record can be taken.

To cover an acre 1 inch deep with water, that is supposing none soaks away, is equal to 22,687½ gallons, or over 100 tons. An irrigation equal to 4 inches of rain would thus require (22,687½ x 4) 90,790 gallons. Therefore, a crop that needs three waterings per season (as fruit-trees) requires 90,790 x 3, equal to 272,370 gallons per acre.

The estimated flow from the Moree Bore is 837,250 gallons per twenty-four hours, and, if this was all available for irrigation, would irrigate over 9 acres per day, equal to a 4-inch rainfall. With a crop that only requires watering every fifty days, 450 acres could be irrigated before the first part required watering again; but for a crop like lucerne, which requires water at least every thirty days, only 270 acres could be effectively irrigated.

There are times, however, when the black-soil plains are so dry and cracked that the full flow of the bore will run down one crack for hours,

and when in this condition, considerably more than 4 inches of water per acre is required. Irrigating from a small stream or trickle is most wasteful of labour, a good head or flow of water being necessary to get over the ground in the quickest and most economical manner.

Chemistry in relation to Irrigation.

The "man with the shovel," as he wades about in the black mud under the scorching western sun, is sometimes apt to view with contempt the theoretical suggestions of the scientific man, and he often feels confident that the "man of science" would find little application for his scientific theories when actually face to face with the problem of spreading a stream from a 10-inch pipe over the black-soil plain.

But, although this idea may exist in certain quarters, there is no doubt that a scientific knowledge can be successfully applied to artesian irrigation. As the ordinary farmer to successfully compete in the world's market must use the most modern and scientific methods of production, so the artesian irrigator should work hand-in-hand with the agricultural chemist. From the time of sinking the bore to the analysis of the water and soil, the assistance of the scientific man is a great advantage, and it is as well to remember that the Agricultural Department will at all times make a gratis analysis of artesian water or soils on receipt of samples and particulars. As before remarked, the quantity of soluble salts in the water is of great importance. Many of our bores contain potassium salts, which are used as plant-food, and water from some of the artesian wells in the Algerian Sahara is reported to contain nitrates, and have produced wonderful oases in the desert sands. The analysis of the water from the Moree Bore, as determined by Mr. Guthrie, Chemist to the Department of Agriculture, is as follows:—

Analysis of the Water.

	Parts per 1,000.	Grains per gal.
Total solid matter	·64	44·5
Loss on ignition	·04	2·6
Saline residue	·60	41·9
Chlorine	·06	4·2
Equivalent to sodium chloride (com. salt)	·10	7·2
Alkalinity, calculated as sodium carbonate	·49	34·3

It will be noticed that the water contains 44½ grains of solid matter per gallon, of which thirty-four parts are sodium carbonate, the most injurious salt. In order to see if the continual irrigation had affected the soil, samples were forwarded for analysis. Sample No. 1 was taken from land that had been irrigated and cultivated for the past seven years, and sample No. 2 from virgin ground adjoining. The most noticeable difference in the mechanical analysis is the decreased proportion of

clay and corresponding increase of sand in the cultivated or irrigated land.

Mechanical Analysis.

Sample.	Fine soil.		Analysis of fine soil.	
	Sand.	Impalpable matter, chiefly clay.	Moisture.	Volatile and combustible matter, mostly organic.
1. Cultivated soil	18·	71.	8·13	5·29
2. Virgin soil	13·33	78·35	9·70	6·10

Fertilising substances soluble in hot Hydrochloric Acid.

Sample.	Lime.	Potash.	Phosphoric Acid.	Nitrogen.
1. Cultivated soil	·760	·350	·091	·035
2. Virgin soil	·640	·387	·074	·063

It will be noticed that the proportion of plant-food, especially nitrogen, is greater in the virgin soil, but this is only what would be expected when compared with land which has not only been growing crops for the past seven years, but has also been limed.

Mr. F. B. Guthrie, Departmental Chemist, reports as follows:—" The analysis of these soils shows that the irrigation as practised at the Moree Farm has been without effect upon the alkali content, the cultivated or irrigated land containing no more alkali than the virgin land. The proportion of lime is somewhat higher in the cultivated soil, due no doubt to the application of lime to the soil four years ago. The amount of humus or vegetable matter is less in the cultivated soil, but the difference is so slight that it is more likely to be caused by the method of cultivation adopted than to the action of bore-water. Green manuring is to be strongly recommended, as it will greatly improve the texture of the soil and render it less liable to crack, as well as supplying plant-food. Potassium salts are present in fair proportion, and these are available as plant-food. It would appear that the *method of cultivation adopted is quite sufficient to prevent any deleterious effects from the use of bore-water.*"

Now, if one watering is equal to 90,750 gallons, and each gallon contains 34 grains of sodium carbonate, it would appear that 3,085,500 grains of soda has been applied each watering. With three waterings per year for seven years, this would amount to 4 tons 2½ cwt. per acre. The ordinary fruit trees do not absorb much of this salt—the problem is, where has it gone to? It may be collected somewhere in the soil just below the plough line (samples were taken to a foot deep), but most likely

the winter rains and subsequent irrigations have washed it down into the subsoil or away out of the soil altogether. The fact remains that the trees and crops are growing well (see illustrations), and thus support Mr. Guthrie's opinion in the laboratory, where further investigations are being made.

Irrigated Crops—Cereals.

Crops grown for hay on the black soil under irrigation are apt to be coarse unless special care is exercised in selection of varieties. The most suitable varieties of wheat are Zealand, Australian Talavera, and White Lammas. Steinwedel and Manitoba also make good hay, but if any rain comes on top of an irrigation, are apt to get rusty. The new cross-breds, Schnieder and Plover, are good hay wheats, and have shown more rust-resistance than the original Purple Straw. If the land has been prepared during the summer, it should be cross-ploughed again before April, and the seed sown not later than May, if possible. If the ground is very dry at planting, and no rain falls for a month, the ground should be soaked (not flooded) in the manner described to get the wheat above ground by June. As soon after irrigation as the ground will carry the horses without bogging, the crop should be harrowed, and the harrowing should be repeated several times until the crop gets up to a foot high. The harrow used should not be too heavy, to tear up the wheat, the lever-toothed harrows being the best for this purpose. This harrowing destroys the crust, fills up cracks, and, by checking evaporation, secures an even supply of moisture. If the crop threatens to come into ear during the period of frosts, it is sometimes advisable to cut it, or feed off by sheep. This will check the top growth, and, by causing it to tiller out, make finer hay, but it is not always advisable for grain.

After the sheep are removed, the crop should be again harrowed, and if the weather has been very dry, may sometimes require an irrigation by September; but, as the evaporation is not very great during the winter months, the second and final watering can generally wait until October. However, the time of watering depends a great deal upon natural rainfall—a crop at, say, Milparinka with an 8-inch rainfall will require much more irrigation than at Moree with over 20 inches of rain. The hay crop is generally ready to cut in November, when flowering, and the yield may be anything between 2 and 4 tons per acre. Wheat for grain should be drilled in at the rate of 45 to 50 lb. per acre in May, and if the ground is moist when sown, one irrigation is often sufficient, provided the ground is well harrowed. A fall of rain or an irrigation just as the crop begins to flower is necessary to cause the heads to fill up, otherwise the grain will be pinched. Excessive moisture at this period is reported to affect the gluten content, but so far we have very little accurate information on artesian irrigated wheat, and further experiments are necessary to obtain definite facts.

Oats will thrive better in wet soils than wheats, and if for hay, must be sown very thickly on the black-soil plains. From 2 to 3 bushels of seed per acre is the usual quantity, and the Algerian, Red Rust-proof, and Dun oats have proved the best varieties. Other varieties are likely to grow very coarse, and are not liked by stock, but this matter of taste is not peculiar to oats produced by bore-water, as is sometimes reported. Oaten hay made from Black or White Tartarian, wherever grown, is never relished so much by stock as that made from Algerian.

Barley is treated similarly to oats, but can be sown earlier, and two or three cuttings often obtained. The crop should be irrigated and harrowed after each watering. A green crop of barley and vetches is often very valuable for breeding ewes, but if not required, can be made into ensilage. It is not so suitable for hay, on account of the beards, unless the awnless variety is sown. Experiments in America have shown that barley will grow on soil containing much more alkali than other cereals, but this has not been definitely proved here yet.

Maize is best sown in drills about 3 to 4 feet apart, and irrigated between. Experiments at Moree have proved that the ground should be moist before sowing, as if seed is sown in dry soil and then irrigated, much of the seed will fail to germinate. If waterfowls or native companions eat the grain, it is best to soak it in a weak solution of coal-tar, but it must all be sown the next day, or it will spoil.

The best results have generally been obtained from the later sown maize crops,—end of December or early January—for as February is the month of the greatest rainfall, the conditions are more favourable for cobbing. This is always a very uncertain crop, however, as hot winds may at any time burn off the tassels, and no grain result. Thorough cultivation is most essential for this crop, as it requires more moisture than other cereals. If it receives a check, it is apt to tassel at a very early stage, and it also requires hilling at an early stage when grown on the black soil. Quick-maturing kinds like Red Hogan and Star Leaming give better results under these conditions than the later varieties. It was noticed that when the rows were sown north and south that they did not get so burnt as when east and west. This was only one season's experience, but as the hot winds come from the west, it might be worth consideration.

Lucerne.

This is, perhaps, the most profitable crop to grow under artesian irrigation, provided good, deep alluvial soils are selected; but the results on black soil at the Moree Farm have not, so far, been altogether satisfactory. It is true that seven cuttings were obtained last year, but the amount of fodder obtained was light, as after the fourth year the roots reached a yellow clay subsoil, which, combined with the cracking nature of the ground, caused the plants to come into flower at a comparatively low height.

The original lucerne plots, which have been planted for five years, were irrigated in furrows 8 to 10 feet apart, but after a few years these became puddled, and, in spite of harrowing, the water would not soak well unless the soil was very dry. It was noticed that the water had to run so long before the lucerne in the centre was soaked, that the plants right against the furrow got drowned out, unless great care was exercised. It was, therefore, found advisable to make an embankment across the lower end and flood the whole area quickly with a good head of water. Where the ground has an even slope, embankments may be made across the plain a distance of 2 chains apart, and as the top section is flooded, the embankments are opened and the escape water runs off on to the next plot. This is a convenient method on alluvial soils, and Mr. Borthwick, of Mascot, *viâ* Woolabra, has also proved it satisfactory on the black-soil plain with artesian water. The best variety of lucerne yet tried is the broad-leafed Tamworth, and the quantity of seed required for broadcast sowing is 15 to 18 lb. per acre. As continually flooding the clay soil makes it very hard and renders frequent harrowing necessary, while irrigation furrows close together are inconvenient in mowing and harvesting, it is difficult to advise which method is the best; but further experiments are being conducted, which it is hoped will give better results on this soil.

In the case of a lucerne crop which is cut and watered seven or eight times during the year, it is apparent that much more water will be applied than if the area was planted with a winter cereal crop; therefore, if the bore-water contains a high percentage of alkali, the ground will become impregnated with salts in a much shorter time than on the other portions of the irrigated land. However, as there is generally plenty of land available, the owner should be satisfied, after obtaining seven crops per year for, say, ten years, to let that piece of land go out of cultivation.

The bore-water should be kept off for a year, the remaining lucerne ploughed up, and the land fallowed, after which it could be planted with salt-bushes.

Experiments in America have proved that our Australian salt-bush is one of the best plants to grow on alkali land, and a plantation of these, besides bringing the land back to its original state, would act as a nursery from which to propagate seeds and cuttings.

Irrigated Grass Land.

Whilst it might not pay to irrigate an extensive area of the native grasses, it is often very convenient to irrigate the horse paddock, or a few acres near the homestead for brood mares or dairy stock. The water is generally flooded on in a very primitive manner, and an excessive quantity is frequently used, with the result that parts of the paddocks become water-logged and the grass drowned. Where the ground is wet under foot throughout the entire growing season, a rank growth of swamp grasses (*Panicum crus-galli* and *Paspalum distichum*, &c.) gradually replaces the better grasses—as Blue grass (*Andropogon sericeus*), and Mitchell grasses

(*Astrebla* sp.), and this swampy growth is apt to be sour and rank, and not relished by stock. On this account, it has been reported that "stock will not eat grass grown with bore-water"; but the same swampy conditions can be produced by any water. The horses at the Moree Farm are always fed on irrigated grass or hay produced by bore-water, and are always in good condition; an adjoining settler also keeps twenty milking cows all the year round on 80 acres of these irrigated paddocks.

Stock should not be turned into an irrigated paddock until the ground is thoroughly dry, or it will cut up badly. Couch grass (*Cynodon dactylon*) generally appears with the application of bore-water. This spreads rapidly and takes possession; but, although a good summer grass, it is not so good as many of the plain grasses which it supplants.

Of the exotic grasses, the Prairie (*Bromus unioloides*) is one of the best winter grasses.

Paspalum dilatatum does well under irrigation in sandy soils, but has not grown so luxuriantly on the clay soils as the more recently introduced Rhodes grass, which promises to be a valuable introduction.

Crop of Amber Cane Sorghum.
Grown on land that has been irrigated with bore-water for six years.

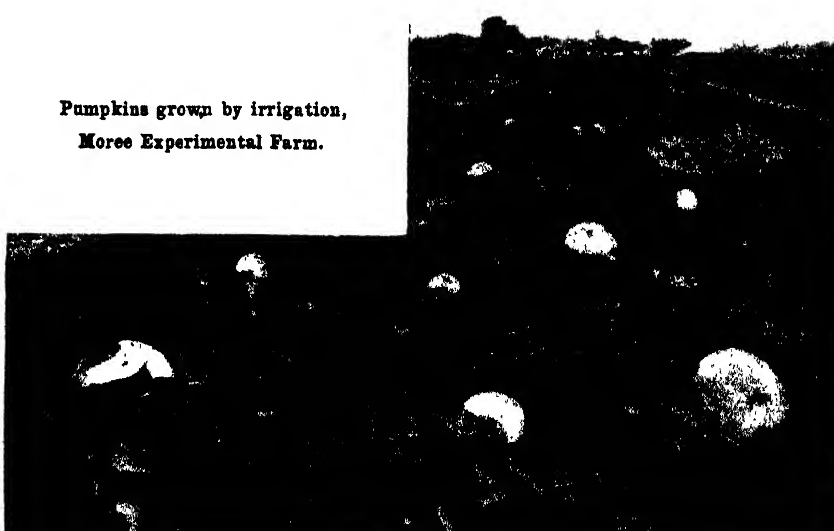
Miscellaneous Crops.

Sorghum is, perhaps, the most profitable crop to grow on the black soil, as, under irrigation, over 20 tons green feed per acre can be produced from two cuttings.

It is more easily watered if sown in drills at the rate of about 12 lb. per acre, which method is also more economical of seed; but if a drill is not available, it can be broadcasted at the rate of 18 to 20 lb. per acre. This crop can be sown in November, after the hay crop has been harvested, and can then be got off in time for another hay crop.

Crop of Cowpeas—Moree Irrigation Farm.

Sorghum drilled in the wheat stubble without ploughing and then irrigated has grown 10 feet high in ten weeks. Pumpkins, and even quick-maturing corn, have been treated in the same way; but this method involves double labour and an extra drain on the plant-food in the soil.



Pumpkins grown by irrigation,
Moree Experimental Farm.

Cowpeas are a very useful crop to grow in a rotation or, as a green manure, between the hay crops, and with an irrigation to germinate them can always be relied on to make a good leaf growth (see illustration).

Pearl millet has also been grown to a height of 6 feet in nine weeks from sowing. When it is necessary to obtain green fodder immediately, French millet is about the quickest summer crop, as this has been cut in six weeks from sowing.

Dwarf Essex rape is also a very quick crop in spring or late autumn, and is splendid for topping up mutton sheep. It is probable that much of the land near existing railway lines could be profitably devoted to cross-bred mutton sheep, as good crops of mangolds, kale, rape, mustard, and turnips can be produced any time during the cooler months by the aid of artesian water.

Pumpkins and melons are sown in stubble land in furrows 15 feet apart, and irrigated. Extra furrows are then ploughed towards the plants after each watering, until the whole space between has been ploughed and cultivated. As the young plants are usually attacked by the pumpkin beetle (*Aulacophora hilaris*), on account of the number of native cucurbitaceæ weeds growing on the plains, they require frequent dusting with fine ashes or spraying with Paris green. Melons do better on sandy than clay soils, although good crops have been grown in selected parts, being sown closer than pumpkins.

Vegetables and Fruit-trees.

In the western districts the growing of vegetables is generally left to the Chinese gardener, who irrigates in the manner peculiar to his country. There is no doubt, however, that the industry would be profitable to Europeans, who, in most cases, can produce better-quality vegetables, by the use of less water and more cultivation. During the winter months, splendid crops of cabbages, cauliflowers, turnips, and peas are grown on the black soil, but in summer it is necessary to cultivate more hardy kinds. If French beans are grown, they are best sown on the lee side of a row of sorghum, or a breakwind, to protect them from the hot blasts, the Haricot variety has proved more hardy than the Canadian Wonder. Spinach is a very good plant to grow under these conditions, and both the "Silver Beet" and New Zealand spinach have given good results. Two hardy vegetables are the climbing choko and the spiney African cucumber; these are very useful to cover unsightly fences, while the latter when ripe makes a splendid fruit salad. The white cowpea will stand any amount of heat, and can be used as a vegetable in various ways; and, of course, cucumbers, squashes, capsicum, and tomatoes are produced in abundance. All these plants are usually sown in rows about 3 feet apart, and well cultivated between with the Planet Jr. horse-hoe. Water is applied by soakage from a centre furrow, which, followed by a good cultivation, has proved more effective than daily sprinkling with a hose.

In watering fruit-trees, the water is allowed to soak gradually through furrows on either side of the trees. In the clay soil one furrow is found sufficient, but if the soil is sandy, two or more furrows are required in the

centre. If possible, it is best to have a permanent wooden flume along the top side of the orchard instead of making a head drain for every watering. The water can then escape through $1\frac{1}{2}$ inch auger holes covered by a small piece of tin fixed by a tack at the top, so that the water can be regulated by partially closing the hole; the holes for convenience should be opposite each furrow. By this means the water can be distributed evenly. As soon as possible after watering, the ground is well stirred with a horse cultivator, which is found very necessary to keep the soil in good tilth and maintain an even degree of moisture. Early cultivation is most essential, that is, when the track behind the cultivator turns up black and moist; if it only leaves dry dust, the cultivation has

Fruit-trees—Grown under irrigation, Moree Experimental Farm.
These trees have been irrigated for five and a half years with bore-water.

been too late. This cultivation is continued fortnightly throughout the summer.

A common reason advanced against the growth of fruit-trees in the dry districts is the white ants or termites. These pests, which are more common on the red soil and "carbene" country than the black soils, are certainly very destructive and difficult to treat, as any mixture that will kill the ants is likely to injure the tree. Care should be taken before planting to remove all dead stumps and decayed wood, to keep any soft-wood stakes away from young trees, and not to cut and damage the surface roots. When a pet grape vine or fruit-tree in the garden is attacked, a dressing of Kainit around the roots before watering will sometimes drive them away. Fresh fowl manure, and the calcium carbide refuse has occasionally had good effect, but there is a risk of over-dosing.

The trees in the illustrations, which are five and a half years old, are growing on black soil which has been irrigated with bore-water since 1898, but, owing to the thorough cultivation, the soil is in good tilth.

Apricots, peaches, nectarines, grapes, lemons, and Japanese plums have all grown and fruited satisfactorily; but the apples, cherries, and English plums have proved unsuitable for the district, and will ultimately be replaced by more profitable varieties. The trees on the right of illustration are (first) persimmons and then apples, which have not grown so well as the apricots and peaches on the left, or in the other picture. Other fruits growing which do fairly well are oranges, pears, quinces, almonds, olives, mulberries, figs, sultanas, prunes, and walnuts. The ground should be always graded or levelled before trees are planted, as the water lying in low spots causes collar rot and other troubles.

Underground drainage is always considered necessary for successful irrigation on clay soils; but, so far, no artificial drains have been laid in the Moree orchard. It is considered necessary, however, to put a few

View of portion of Moree Orchard.
Showing good growth of peaches and apricots on the left and indifferent growth of apples and persimmons on the right.

underground tile drains in the lower end, which will probably be conducive to more permanent results. Owing to the distance from a railway and the cost of pipes it is not probable that this matter will ever receive the attention it deserves from the artesian irrigator; but if pipes could be cheaply obtained there is no doubt that the beneficial results would soon repay the expense.

If the subsoil is clay, at least the homestead garden and orchard should be underground drained, if possible.

Visitors have frequently remarked that if the water could be applied under the soil it should have a better effect, by lessening the evaporation. Sub-irrigation from pipes, as this is called, however, is too expensive to be commonly adopted, and unless the subsoil is a tenacious clay, the water is more apt to go downwards than spread out in a lateral direction.

Applying the water through fairly deep newly-made furrows has practically the same effect, and is cheap and simple.

These remarks are based upon the actual results obtained at the Moree Farm and from observations around the district; but the following extract from the *Daily Telegraph* of 20th February, 1906, may lend additional weight to the statements:—

"ARTESIAN IRRIGATION—SOME SUCCESSFUL EXPERIMENTS.—As bearing on the discussion as to the value of artesian water for irrigation purposes, the following statement, furnished by Mr. A. Butler, late of Glenbrook Farm, about 16 miles from Walgett, on the road to Coonamble, is of special interest. The land in question adjoins Dalgety's Euroka pastoral holding.

"Mr. Butler says:—'I have had six years' experience with bore-water, and have been very successful. I have grown wheat and oats up to 6 ft. 6 in. in height, and averaging 3 tons to the acre of hay. I have grown crops five years in succession on the same land, and the last crop yielded 50 bushels of oats, 20 bushels of wheat, and 30 cwt. of hay to the acre, so I think that is clear proof that bore-water has no bad effect on the soil, as some try to make out. The land that the above yield was taken from was irrigated ten times in the five years.

"'In the 1902 drought, I grew a crop of hay with bore-water alone, and cut 2 tons to the acre. There were about 20 acres of it, and it was the third crop off the same land.

"'Now, some persons say that bore-water will only grow one crop on the same land, and that horses will not eat oaten hay grown by the water; but in both cases these people are wrong, because I have proved it, and will prove it again. If farmers were to pay more attention to the variety of cereals they sow, and knew when and how to cultivate their crops, and gave the land more surface cultivation, there would not be so many failures.

"'Another important matter is the harvesting of a crop. What is the good of growing a crop if you do not know how to cure it? I have seen crops left in the field until they are perished—blown about, and perhaps it rains on them—and then, when stock will not eat this rubbish, they say it is because it was grown with bore-water.

"'Now, I have grown hundreds of tons of hay by bore-water, and never had a complaint yet. I have sold oaten hay grown by bore-water to old trainers for racehorses—who, as a rule, are very particular—and never had a complaint from them; in fact, they took it in preference to imported hay brought to the district for their use. And now, in conclusion, I will give you a list of the different crops that I have grown with artesian water:—Wheat, oats, barley, rye, amber cane, millet, lucerne, rape, onions, potatoes, and all kinds of vegetables. What is more, I have never had any failures yet.'"—*Daily Telegraph.*

(To be continued.)

An Experimental Test of Rodier's Method of Rabbit Extermination.

By JAS. D. STEWART, M.R.C.V.S.,
Government Veterinary Surgeon.

By direction of the Honourable the Minister for Lands, the following experimental test of the method of rabbit extermination, advocated by Mr. W. Rodier, of Tambua, was carried out at the Randwick Stock Quarantine, between 7th May, 1905, and 11th April, 1906.

Six pens, each 18 feet by 12 feet in dimension, had been specially erected in an isolated part of the quarantine grounds. Each pen was made rabbit-proof by being enclosed with wire-netting of 1¼ inch mesh, from a depth of 1 foot below a bed of sandstone formation, and 5 feet 6 inches below the surface of the ground to a height of 4 feet 6 inches above, and capped with an additional 2 feet of netting, inclined inwards and upwards, all connections being securely spliced.

In compliance with the directions that several lots of rabbits were to be kept in different enclosures—(a) bucks and does in equal numbers, (b) bucks in excess, and (c) does in excess; proportions to be varied in (b) and (c),—wild rabbits, that had been trapped in the Gundagai district, were placed in the pens as follows:—

On 7th May, 1905.—	Pen No. 1—	Does 9,	bucks	3—	ratio, 3 to 1.
„ „	Pen No. 2—	„ 6,	„	6—	ratio, 1 to 1.
„ „	Pen No. 3—	„ 8,	„	12—	ratio, 2 to 3.
„ „	Pen No. 4—	„ 4,	„	12—	ratio, 1 to 3.
On 23rd May, 1905—	Pen No. 5—	„ 0,	„	10.	
	Pen No. 6—	„ 11,	„	1.	

As the rabbits were placed in the pens they were ear-marked in the following manner:—Those of Pen No. 1, V left ear; Pen No. 2, W left ear; Pen No. 3, VVV left ear; Pen No. 4, V right ear; Pen No. 5, W right ear; Pen No. 6, VVV right ear. Bucks were marked V in the point of the fellow ear, in addition.

These rabbits were very wild, and as many had been injured during transit and whilst being handled, it was not surprising to find, within a short period, several dead in different pens. It consequently became doubtful whether the proportion of does had been maintained sufficiently long to give reliable results, and it was decided to recommence the test. During July, 1905, the rabbits in each pen were, therefore, dug out, caught, and recounted, with the following result:—

Pen No. 1—

7th May, 1905—Liberated, does 9, bucks 3.
2nd July, 1905—Collected, does 7, bucks 3, and 4 newly-born kittens.
Result—Decrease, 2 does; increase, 4 kittens (dead).

Pen No. 2—

7th May, 1905—Liberated, does 6, bucks 6.

7th July, 1905—Collected, does 6, bucks 6.

Result—Decrease, *nil*; increase, *nil.*

Pen No. 3—

7th May, 1905—Liberated, does 8, bucks 12.

19th July, 1905—Collected, does 5, bucks 10.

Result—Decrease, does 3, and bucks 2; increase, *nil.*

Pen No. 4—

7th May, 1905—Liberated, does 8, bucks 12.

21st July, 1905—Collected, does 2, bucks 7, and 5 kittens.

Result—Decrease, does 2, and bucks 5; increase, 5 kittens.

Pen No. 5—

23rd May, 1905—Liberated, 10 bucks.

21st July, 1905—Collected, 10 bucks.

Result—Decrease, *nil.*

Pen No. 6—

23rd May, 1905—Liberated, does 11, bucks 1.

21st July, 1905—Collected, does 11, bucks 1.

Result—Decrease, *nil*; increase, *nil.*

On 22nd July, 1905, the rabbits in pens No. 1, No. 2, No. 3, and No. 4 were restored to their original proportions by transferring the requisite numbers from pens No. 5 and No. 6, and adjusting the distinctive earmarks accordingly. A further supply was then obtained from the same source at Gundagai, added to pens No. 5 and No. 6; and on the 3rd September, 1905, these two pens contained—does 0, bucks 12, and does 13, bucks 3, respectively. The rabbits soon settled down, and began to thrive and fatten.

During the subsequent months many young rabbits were observed in all pens (No. 5 excepted); and, as an evident increase had occurred, it was decided towards the end of March, 1906, to terminate the test.

In digging the rabbits out considerable difficulty was experienced, owing to the depth and anfractuous nature of the burrows. During the process several carcases and skeletons of rabbits were found, while two rabbits were accidentally killed. In no instance had any of the burrows penetrated or undermined the netting.

As the rabbits were caught they were carefully counted, their earmarks identified, and sex determined, with the following results, *i.e.*:—

Pen No. 1—

22nd July, 1905—Liberated, does 9, bucks 3 (earmarked); total ...	12
30th March, 1906—Collected, does 6, bucks 2 (earmarked)... ...	8
„ „ does 15, bucks 9 (not earmarked) ...	24
Total...	32

Result in 251 days—

Decrease in original rabbits = does 3, bucks 1; total 4

Increase—does 15, bucks 9; total 24

Pen No. 2—

7th May, 1905—Liberated, does 6, bucks 6 (earmarked); total ..	12
30th March, 1906—Collected, does 5, bucks 5 (earmarked) ...	10
" " does 21, bucks 4 (not earmarked) ...	25
Total	35
Result in 327 days—	
Decrease in original rabbits = does 1, bucks 1; total	2
Increase—does 21, bucks 4; total	25

Pen No. 3—

22nd July, 1905—Liberated, does 8, bucks 12 (earmarked); total...	20
7th April, 1906—Collected, does 7, bucks 10 (earmarked)... ...	17
" " does 11, bucks 5 (not earmarked) ...	16
Total	33
Result in 259 days—	
Decrease in original rabbits = does 1, bucks 2; total	3
Increase—does 11, bucks 5; total	16

Pen No. 4—

22nd July, 1905—Liberated, does 4, bucks 12 (earmarked); total...	16
7th April, 1906—Collected, does 4, bucks 9 (earmarked)	13
" " does 7, bucks 4 (not earmarked) ...	11
Total	24
Result in 259 days—	
Decrease in original rabbits = does 0, bucks 3; total	3
Increase—does 7, bucks 4: total	11

Pen No. 5—

3rd September, 1905—Liberated, 12 bucks (earmarked); total ...	12
11th April, 1906—Collected, 12 bucks (earmarked); total... ...	12
Result in 220 days—Decrease, *nil.*	

Pen No. 6—

3rd September, 1905—Liberated, does 13, bucks 3 (earmarked); total	16
7th April, 1906—Collected, does 13, bucks 3 (earmarked)... ...	16
" " does 7, bucks 0 (not earmarked) ...	7
Total...	23
Result in 216 days—	
Decrease in original rabbits = *nil*	0
Increase—does 7, bucks 0	7
Total...	7

Remarks.

The method of extermination advocated by Mr. Rodier has for its motto, "Kill the females, and let the males go alive"; and the following reasons are advanced for its efficacy, *i.e.*: (*a*) When the males exceed the females in numbers, they persecute them so that they do not breed. They also kill what young may be born, and (*b*), when they largely exceed the females, they worry the remaining ones to death.

Drawing deductions from the result of the test on parallel lines, it is ascertained first as regards (*a*) the effect on increase :—

In *Pen No.* 1—9 does and 3 bucks produced 24 progeny in 251 days; increase per doe = 2·6.

In *Pen No.* 2—6 does and 6 bucks produced 25 progeny in 327 days; increase per doe = 4·1.

In *Pen No.* 3—8 does and 12 bucks produced 16 progeny in 259 days; increase per doe = 2.

In *Pen No.* 4—4 does and 12 bucks produced 11 progeny in 259 days; increase per doe = 2·7.

In *Pen No.* 6—13 does and 3 bucks produced 7 progeny in 216 days; increase per doe = ·5

It will therefore be seen that the increase has not been as great as one might have reasonably expected had the rabbits existed in a state of freedom under natural conditions, yet the relative increase in pens No. 1, No. 2, and No. 4 are remarkably uniform notwithstanding the different proportions of does mated with bucks, viz., 3 to 1, 1 to 1, and 1 to 3 respectively. The increase in pen No. 2 is greatest, *i.e.*, 4·1 per doe, and cannot be accounted for by the longer period the rabbits in this pen were mated, as all the young were over three months old, while none were present on 7th July, 1905. Pen No. 6 was not regarded as a test pen, as it contained the surplus does; and of the bucks, one was very old and another extremely young when the test was commenced.

With respect to reason (*b*), *i.e.*, When the males largely exceed the females they worry the remaining ones to death,—

In *Pen No.* 1—9 does were mated with 3 bucks for 251 days, and a decrease of 3 does and 1 buck occurred, or a relative decrease in does of 33 per cent., in bucks of 33 per cent.

In *Pen No.* 2—6 does with 6 bucks for 327 days; decrease, 1 doe and 1 buck. Does, 16 per cent.; and bucks, 16 per cent.

In *Pen No.* 3—8 does with 12 bucks for 259 days; decrease, 1 doe 2 bucks. Does, 12 per cent.; bucks, 16 per cent.

In *Pen No.* 4—4 does with 12 bucks for 259 days; decrease, 0 does 3 bucks. Does, nil; bucks, 25 per cent.

Further, at the termination of the test in pen No. 1 the does were much worried; in pen No. 2, bucks appeared more worried than the does; in pen No. 3 all looked well, as also did those in pen No. 4, particularly the does.

It will therefore be seen that the test indicates the likelihood of bucks, even when in excess, worrying the does to death within reasonable period is very remote.

It is of interest to note that in pen No. 5 twelve bucks lived together in a confined space, with does adjacent, in apparent harmonious relations for 220 days.

The result of the test may therefore be summarised as follows:—

1. The preponderance of males tended to decrease the number of young.
2. The males, when in excess, did not generally worry the females to death.
3. The males did not worry each other to any great extent.

Comment.

To bring the method of exterminating rabbits advocated by Mr. Rodier to a successful issue, the natural law of "survival of the fittest" must come into operation, and it appears to have been accepted that when the males predominate and become the superior sex, the females necessarily become exterminated. There, however, exists a theory accepted by some as a natural law which tends to avert the extermination of a species by sexual preponderance, namely, the theory of "cross-heredity of sex," the doctrine of which is that the better nourished and superior parent tends to produce the opposite sex. This theory of "cross-heredity of sex" is strongly supported by the result of the test, for it will be seen that in pen No. 1, of the increase 15 were females and 9 males; in pen No. 2, 21 were females and 4 males; in pen No. 3, 11 were females and 5 males; in pen No. 4, 7 were females and 4 males; in pen No. 6, 7 were females (males 0). Further, in the three pens where the number of males equalled or exceeded that of females, the original disproportions were greatly reduced. For instance, 6 males and 6 females were placed in pen No. 2, and 9 males and 26 females collected; 12 males and 8 females in pen No. 3, and 15 males and 18 females collected; 12 males and 4 females in pen No. 4, and 13 males and 11 females collected. It is therefore obvious that, unless extensive destruction of females is continuously carried on, the sexual balance soon becomes restored.

Formulating an opinion upon the result of this experimental test, it would appear that the method of exterminating rabbits advocated by Mr. Rodier entails prolonged and continuous destruction of females and the depasturing of a considerable number of males for an extensive period, while the chances of ultimate success seem to rest in a pertinacious effort to kill the last doe.

Sheep and Salt-bushes, Coolabah Farm.

Feeding Experiment.

R. W. PEACOCK.

Salt-bushes are remarkable for their drought resistance. As regards their fodder value, there is a considerable diversity of opinion respecting them. Many pastoralists have recognised their value, and have done something towards their conservation and also cultivation.

The practicability of cultivating them has been demonstrated at the Coolabah Experimental Farm, where 70 acres were placed under many of the best varieties. As a fitting sequel to this work, a sheep-feeding experiment was carried out, with the following objects in view :—

1st. To test whether sheep could live for a given time upon salt-bush alone.
2nd. The effect of such a diet upon a ewe carrying a lamb.
3rd. The effect of such upon the wool.
4th. The effect upon the quality of mutton.
5th. The value of the different varieties as a sheep fodder.
6th. To gain some idea of the carrying capacity of salt-bush country.

As regards the first, many may think that such is frequently tested with every recurring drought; but such cannot be claimed, as it is impossible to restrict stock to a salt-bush diet solely under natural conditions, there being so many different fodders entering into their dietary which may or may not be essential to their health. Seeds and leaves and other fragments of trees, shrubs, grasses, and herbs may enter considerably into their diet without being apparent to the owner.

In order to guard against anything of this nature, the sheep fed upon salt-bushes alone were penned, and the salt-bushes hand-fed to them. For the purpose of this experiment, fifteen sheep were purchased from Messrs. W. and T. C. Dickson, of Yarrawin, Brewarrina, comprising six-tooth wethers and ewes. They were selected from this flock on account of their previous knowledge of salt-bush and having been reared under similar conditions as existed at the Coolabah Farm. Being flock sheep, they were allowed to run together upon the farm for two months before being penned, in order to get used to their surroundings.

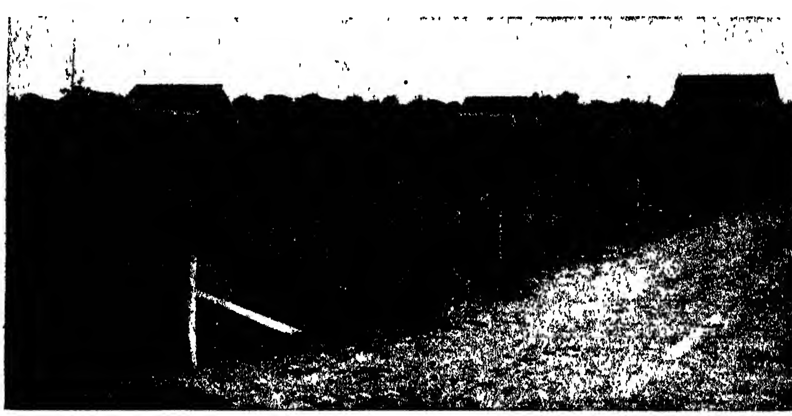
Upon the 1st December, 1904, three ewes and two wethers were placed in pen No. 1 to be fed upon salt-bushes alone. In pen No. 2, two ewes

and two wethers were placed to be fed upon a mixed diet, so as to act as a check upon No. 1 pen. The remaining six sheep were allowed to run in a paddock of cultivated salt-bushes, the area of the paddock being 6½ acres. The area of each pen was $\frac{9}{40}$ of an acre, or a little more than 2 chains by 1 chain.

Upon the 1st December, each sheep was weighed. In pen No. 1 the sheep received as much salt-bush as they would eat throughout the experiment.

In pen No. 2 they were fed upon salt-bushes, hay, grass, green-stuff, &c. Shelter and water were provided in each pen.

After four months, sheep from pen No. 2, which were being fed upon mixed diet, were turned out into the paddock with the other six, as it



Paddock of Salt-bush in which sheep were run.

was considered that any fretting pen No. 1 had indulged in owing to close confinement had been sufficiently checked.

Owing to the very heavy rains of April, totalling 11·47 inches, the pens were flooded, and the sheep in confinement in No. 1 pen suffered considerably on account of this, and also the cold weather.

A ram was mated with the ewes on 11th January, 1905.

The sheep were shorn upon the 15th August, 1904, and were again shorn on the 16th August, 1905, the clip being of twelve months' growth.

As regards No. 1 pen, the last eight and a half months' growth was made upon a salt-bush diet alone.

The following weights will prove interesting in gauging their progress for the twelve months during which the experiment lasted.

PEN No. 1.—Sheep fed on Salt-bush alone.

Sheep No.	Weight on 1/12/04	Weight on 16/12/04	Weight on 16/1/05	Weight on 16/2/05	Weight on 1/3/05	Weight on 31/3/05	Weight on 10/5/05	Weight on 10/6/05	Weight on 8/7/05	Weight on 16/8/05	Wool.	Weight on 13/9/05	Weight on 30/11/05	Remarks.	Greasy Wool, average per sheep.	Scoured Wool, actual clean yield.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.		lb. oz.	lb. oz.
Wether 1 ...	116	118	118	114	...	...	...	..	.	88	11	102	110			
Wether 2 ...	98	100	101	103	...	...	...	.	...	78	12¾	95	99			
Ewe 1	94	98	101	100	...	..	...	...	..	75	9¾	91	97	1 lamb dropped......	10 10	5 0
Ewe 2	92	96	98	97	...	...	..	...	...	77	10	87	91			
Ewe 3	93	97	102	94	...	...	...	...	...	77	9¾	93	80			
Total for pen.	493	509	520	508	483	479	436	429	461	395	53¼	468	477	Loss, 16 lb. Average per sheep, 3¼ lb.		

PEN No. 2.—Sheep fed on Mixed Diet.

Sheep No.	Weight on 1/12/04	Weight on 16/12/04	Weight on 16/1/05	Weight on 16/2/05	Weight on 1/3/05	Weight on 31/3/05	Weight on 10/5/05	Weight on 10/6/05	Weight on 8/7/05	Weight on 16/8/05	Wool.	Weight on 13/9/05	Weight on 30/11/05	Remarks.	Greasy Wool, average per sheep.	Scoured Wool, actual clean yield.
Wether 1 ...	111	116	115	115						92	14	114	133			
Wether 2 ...	102	111	113	111	Turned into salt-bush paddock, 1/3/05.					101	12¼	108	114			
Ewe 1	77	85	87	91						75	12½	85	85	2 lambs dropped ...	12 13	5 7
Ewe 2	82	92	86	89						88	12½	102	90			
Total for pen.	372	404	401	406	371	...	342	365	365	356	51¼	409	422	Gain, 50 lb. Average per sheep, 12½ lb.		

SHEEP running in Salt-bush paddock.

Sheep No.	Weight on 1/12/04	Weight on 16/12/04	Weight on 16/1/05	Weight on 16/2/05	Weight on 1/3/05	Weight on 31/3/05	Weight on 10/5/05	Weight on 10/6/05	Weight on 8/7/05	Weight on 16/8/05	Wool.	Weight on 13/9/05	Weight on 30/11/05	Remarks.	Greasy Wool, average per sheep.	Scoured Wool, actual clean yield.
6 sheep ...	482	...	...	...	517	...	456	480	487	448	74¼	534	549	4 lambs dropped ... Gain, 67 lb. Average per sheep, 11⅙ lb.	12 6	5 4

NOTE.—The proportion of scoured to greasy is based upon the results of the samples scoured, and may be in excess of the results if the whole bulks had been scoured. They are nevertheless comparative.

It will be seen that the sheep of both pens steadily improved for two and a half months.

No. 1 pen reached its lowest weight in June, 1905, having suffered considerably from the wet and cold. It will also be noticed that the sheep running in the paddock were at their lowest when weighed in May, after the excessive rains of April.

The sheep in pen No. 1, although having lost weight, were perfectly healthy, and the wool was in good condition when weighed upon the 10th June. By this date this pen had lost 64 lb.; this loss only represents a portion of the actual condition lost, as during this time wool was growing at the rate of 4 lb. 7 oz. per month, totalling for the seven months 31 lb. 1 oz. This, added to the apparent loss of 48 lb., would be 79 lb. 1 oz., or 15 lb. 13 oz. per sheep. From this date to the end of the experiment they gained 48 lb.: this, added to the difference in the weight of seven months' wool and three and a half months' wool, viz., 15 lb. 8½ oz., would mean an increase of 63½ lb., or 12 lb. 11 oz. per sheep.

This calculation is based upon the assumption that the growth of wool, as regards its weight, was uniform throughout the year. This, of course, is not exactly the case. It will be seen that, when weighed in June, they carried nearly seven months' wool grown during the experiment, and when weighed on 30th November only three and a half months' wool. One of the ewes also dropped a lamb, which, under the conditions, interfered with her condition. This ability to put on actual condition, irrespective of wool, at the rate of 3 lb. 1 oz. per sheep per month, bears testimony of the general tone and vigour of the sheep towards the end of the experiment.

2nd. As regards the effect of this diet upon the ewe in lamb, the following is interesting:—

From	ewe	No. 1 pen,	1 lamb,	lambed	9/10/05;	29 lb	weight on	5/12/05.
,,	,,	No. 2 ,,	1 ,,	,,	10/10/05;	37 ,,	,,	5/12/05.
,,	,,	No. 2 ,,	1 ,,	,,	15/11/05;	18 ,,	,,	5/12/05.
,,	,,	from paddock,	1 ,,	,,	3/10/05;	44 ,,	,,	5/12/05.
,,	,,	,,	1 ,,	,,	4/10/05;	40 ,,	,,	5/12/05.
,,	,,	,,	1 ,,	,,	10/10/05;	died	......	20/10/05.
,,	,,	,,	1 ,,	,,	16/11/05;	16 lb.	weight on	5/12/05.

The lamb from No. 1 pen ewe was healthy, but not in such good condition as lambs about the same age, its mother being rather poor. The other lambs looked healthy and strong.

3rd. The effect of the diet upon the wool may be gathered from the weights given, and the results of the scouring test here attached. These, together with the opinions of Mr. T. C. Dickson, who bred these sheep and selected them for the purpose of this experiment, should prove interesting and valuable in this connection.

Mr. Dickson writes, July 3rd, 1905:—"The sheep in pen No. 1, although low in condition, are thriving, and their skins are healthy and throwing out sufficient yolk to keep the wool in good condition, but the

fibre has wasted very much, this being very noticeable upon the bellies of two of the ewes, and will be very much wasted and fuzzy when rearing lambs; they also lack the density shown when fed on ordinary pasture. When here (Yarrawin) these sheep grew a deep, shafty, combing wool. Now it is a medium quality wool which would realise, I think, a higher price per lb., but not so much per fleece, as they will not cut the weight they did last year. Altogether the sheep have done better than I expected. I knew the fleece would shrink when the sheep were confined to salt-bush, but I thought the tip would be white and fuzzy instead of showing the good tip it does."

The following is Mr. Hawkesworth's report upon the scouring of these wools :—" The scouring of these wools was difficult, as the wool itself was

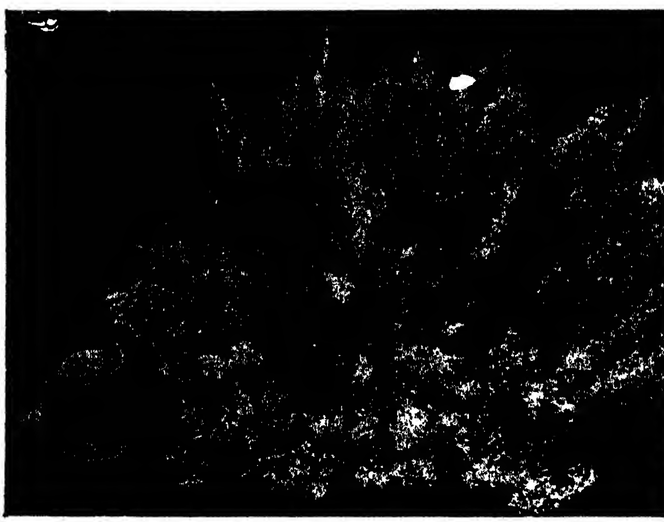
Old Man Salt-bush *(Atriplex nummularia.)*

generally of good quality; therefore, to remove all the yolk and red soil would seriously have damaged the fibre :—

From sheep of No. 1 Pen—
Ewes—Greasy, 26 lb. net.
Scoured, 13¼ lb., yield 51 per cent.
Condition left in 4 per cent. = 48·96 per cent. clean yield.
Wethers—Greasy, 14½ lb. net.
Scoured, 6⅞ lb., yield 47·5 per cent.
Condition left in 4 per cent. = 45 per cent. clean yield.
From sheep of No. 2 Pen and paddock—
Greasy, 71 lb. net.
Scoured, 32 lb., yield 45 per cent.
Condition left in 5 per cent. = 42·75 per cent. clean yield.

4th. As regards the effect of such a diet upon the mutton, opinions only are available. At the termination of the experiment one sheep was killed, and the mutton distributed to solicit opinions. The foreman of the Farm, H. J. Kelly, reports:—"The general opinion of six tasters was as follows:—Mutton dry, tough, resembling very much the mutton used during the heavy drought; flavour sweet. Very little fat was on inside—the kidneys were just covered with a thin film; also paunch."

5th. The value of the different varieties of salt-bushes as fodder may perhaps be gauged in some measure by the partiality of the sheep for them. In this particular, Mr. Kelly reports:—"The sheep were fed upon the following salt-bushes:—*Atriplex nummularia*, *A. vesicaria*, *A. angulata*, *A. semibaccata*, and *A. leptocarpa*, the first-mentioned being the



Atriplex angulata (Species).

chief diet throughout the experiment. They relished a change from one variety to another at all times, but were more partial to *A. angulata* than the other varieties."

6th. As regards the carrying capacity of salt-bush country, the experiment, as far as it has gone, has not demonstrated this point sufficiently, and this section of the experiment is being continued. The paddock into which six sheep were turned on 1st December, 1904, and an additional four turned on the 1st March, 1905, comprised 6½ acres, being equivalent to 8⅔ sheep for the whole twelve months. Two-thirds of this area contained a good plantation of Old Man salt-bush, the remainder having only an odd bush here and there. Respecting this paddock, Mr. Kelly reported:—"There was a fair coat of grass when the sheep were turned in on the 1st December, 1904. This grass was pretty well all eaten by 1st April, 1905, the sheep living chiefly on Old Man salt-bush till July, when a fair

shoot of herbage sprang up. This was not eaten out on 30th November, 1905. Plenty of salt-bush still in paddock, and some dry grass and herbage, 30th November, 1905."

To give a better idea of the conditions at the Farm throughout the experiment, the rainfall is given below :—

December, 1904	...	·64 points.
January, 1905	...	·01 ,,
February, ,,	...	1·34 ,,
March, ,,	...	1·97 ,,
April, ,,	...	11·47 ,,
May, ,,	...	·48 ,,
June, ,,	...	1·25 ,,
July, ,,	...	·72 ,,
August, ,,	...	·39 ,,
September, ,,	...	·1 ,,
October, ,,	...	·9 ,,
November, ,,	...	1·10 ,,
Total	...	19·47 inches.

The above has fully demonstrated the value of these plants as a fodder. It is reasonable to suppose that the results would have been better if excessive rains had not fallen, as such has a bad effect upon sheep, especially when confined. I append an analysis of salt-bush from the Bourke district, by Mr. Guthrie, Chemist to the Department, which is interesting in conjunction with the experiment. My best thanks are due to Mr. T. C. Dickson, Mr. Sutton, Mr. Hawkesworth, and Mr. Kelly for their co-operation.

ANALYSIS OF SALT-BUSH.

Atriplex nummularia. From Bourke (uncultivated).

Moisture ...	56·73
Oil ...	·67
Digestible fibre ...	11·59
Woody fibre ...	3·93
Soluble albuminoids ...	1·76
Insoluble albuminoids ...	3·54
Soluble ash ...	14·14
Insoluble ash ...	2·04
Chlorophyll, amides, and other extractions (by difference) ...	5·60
	100·
Total nitrogen ...	1·20
Amide nitrogen ...	·36
Percentage of common salt in ash ...	56·6

By F. B. Guthrie, *Agricultural Gazette*, Vol. 13, page 860.

A Dairyman's Silo.

How it was Built and what it Cost.

GEO. L. SUTTON.

THOUGH much valuable information relating to the construction of stave silos has already been published in the *Agricultural Gazette*, yet, on account of the increasing interest in this subject, any additional information is sure to be welcomed. It is not proposed on this occasion to discuss the merits or demerits of any of the various methods of converting green fodder into ensilage, nor the advantages or disadvantages of the different types of silos which are in use in parts of this and of the other States, but simply to describe the operations connected with the erection of a stave silo which was built by Wm. Percival,. Esq., on his dairy farm, "Little Clarendon," Richmond. That I am enabled to do this is entirely due to the unfailing courtesy of that gentleman, who generously placed all the information available at my disposal.

As none of those engaged in the building of this silo had ever had any previous experience with this class of work, it is hoped that the brief description of how this silo was built, under the supervision of Mr. Percival, with no other help but that of a skilled carpenter and a labourer, will help to remove from the minds of many the idea, that, in order to build a stave silo it is necessary to have specially trained and expert assistance. There are, of course, difficulties to be surmounted, but most of them are given unnecessary prominence, and many of those anticipated, exist only in the imagination, and simply because the work is of an unusual character.

The silo was erected in December, 1903, so that a reasonable time has now elapsed to afford some idea as to its durability and stability. To-day the silo is in excellent condition, and as firm as when erected. Since erected it has required practically no attention; the hoops have been slightly tightened twice, and recently the inside was treated with a coat of linseed oil. In the spring it will require, and will receive, a coat of paint on the outside.

The estimated capacity of the silo is 150 tons. The dimensions are: height, 30 feet; diameter, 18 feet. It was originally planned to have the silo 20 feet wide, but Mr. Percival was dissuaded from having it this width by a reputed authority on the subject, who assured him that silos with diameters greater than 16 feet were not efficient. Whilst not entirely satisfied with this statement, he felt it unwise, on account of his lack of experience, to carry out his original intention; he, therefore, compromised matters by building a silo with a diameter of 18 feet.* There was, of course, no foundation

* It may be noted that whilst the difference in cost between a silo 18 feet wide and one 20 feet wide would be comparatively small (only ten more staves would be required), yet the capacity would be increased by 35 tons.

for the statement advanced, and Mr. Percival is now so convinced of this, and also of the advantages of, and even of the necessity for, a silo, which he rightly calls "the place where he stores milk," that he intends, and is now making arrangements, to build another one, which is to be 35 feet high and 25 feet in diameter. This is most convincing evidence of how wrong were his neighbours, who scoffed at his enterprise when about to erect the silo, and who, when it was completed, called it, in derision, "The White Elephant." (It is painted white.)

Since its erection, the silo has been almost in constant use; for the owner prefers and finds it economical to pass all greenstuff, except lucerne, which is usually made into hay, through the silo, rather than feed it directly from the paddock to the stock. It must not be inferred that the greenstuff is always allowed to remain in the silo long enough to be converted into ensilage. Such is not the case: the material is fed just as required, and at any time, after it has been put into the silo, and at any stage during its conversion from greenstuff into ensilage. Often the feeding commences as the crop is being cut up, and is continued until such time as the conditions render hand-feeding unnecessary; the feeding then ceases. It is found that except a few inches decay on the surface, that which is left in no way deteriorates. The silo is not always filled at one operation, for the crop sometimes is not sufficiently large to fill it; but whatever there is, it is put into the silo, and if not used at once, there it remains until required, which sometimes is after another crop has been cut up and placed on top of it, in order to fill the silo.

The material put into the silo is chaffed with a No. 2 "Sydney Prize" chaff-cutter, to which has been attached a simple elevator.

This is a long, shallow box, 11 inches wide and 4 inches deep inside measurement. At each end are sprocket wheels, which guide a link belt in the centre of the box. To every seventh ("attachment") link, about $10\frac{1}{2}$ inches apart, is bolted a plain piece of batten, checked out on the bottom edge, as in illustration, to prevent interference with the teeth of the sprocket wheel. These battens, or "carriers," are $9\frac{5}{8}$ inches long, $2\frac{1}{2}$ inches wide, and 1 inch thick. As the carriers pass up the box, they take the chaffed material with them; the greenstuff is guided into the box by a tin hopper fixed to the chaff-cutter. The power to drive the belt is transmitted from a sprocket wheel on the main spindle of the chaff-cutter, by means of link belting to a sprocket wheel fixed on the spindle at the bottom of the elevator. For every twenty revolutions the sprocket wheel on the main spindle makes, that on the elevator makes only fourteen.

Batten with notch cut out to make "Carrier."

The elevator is extremely simple, and is such as could be made and fitted up by any man handy with tools, provided the necessary wheels, belting, spindles, and bearings were available.*

* The link-belting and necessary fittings for an elevator can be obtained from the Link Belt Co., Clarence-street, Sydney.

Many people hesitate to build a stave silo on account of the difficulty they expect to have when they want to fill it, unless they purchase special and costly machinery. Cases are met with where the silo has been located in a position sometimes inconvenient, or an unsuitable one—for instance, in a cutting in a hillside—in order to overcome a difficulty which can be more easily and cheaply overcome by means of a similar elevator to the one described. The chaff-cutter and elevator are easily driven, at the full capacity of the chaff-cutter, by means of 4½ horse-power steam-engine.

Materials required.

The following list supplies details of the materials used in the construction of the silo. The costs given are the actual ones at Richmond, New South Wales. In making estimates for other districts, those variations which are governed by the locality will have to be taken into consideration and allowed for :—

	£	s.	d.
Foundation.—4 logs, 19 ft. long, 8 in. thick ; royalty, 7s. 6d. ; cartage, 2s. 6d....	0	10	0
Kerbing—8 slabs, 7 ft. 6 in. long, 12 in. x 2 in.	0	6	4
Tar—5 gallons	0	2	0
Doorway.—2 pieces dressed hardwood, 31 ft. x 6 in. x 4 in.—124 s. ft. at 10s. 6d.	1	12	0
Boards for doorway—12 in. x 2½ in., Oregon	1	2	7
Walls.—87 staves, 30 ft. long x 8 in. x 2½ in., dressed on both sides, with edges slightly bevelled to form circle, edges grooved to receive slip tongues = 4,385 sup ft., Oregon, at 17s.	37	5	5
87 slip tongues, 1 in. x ⅜ in., each 30 ft. long—2,610 lin. ft., Oregon, at 9d. ...	0	19	7
10 iron bands, ⅝ in. round iron, each band in five pieces, with hinge joints and 3 in. x ⅝ in. square-headed bolts, threaded 8 in. at extreme ends and fitted with nuts ; 9 door stays, ⅝ in. round iron, each end threaded 6 in. and fitted with 2 nuts (4 nuts in all)	8	15	0
*Timber for roof, braces, and elevator.—T. and G. Oregon—168 sup. ft. at 16s. 6d.	1	7	9
4 x 2 Oregon scantling—123 sup. ft. ; 3 x 2 Oregon scantling—148 sup. ft. ; 3 x 1 Oregon scantling—26 sup. ft. ; at 14s.	2	4	0
Octagon pinnacle post, Kauri	0	5	0
3 x 1 Kauri (thirds)—26 ft. at 14s. 6d.	0	3	9
16 sheets 7-ft. iron ; 16 sheets 6-ft. iron—delivered	3	10	8
18 sheets ridge-capping—delivered	1	2	6
Spring-headed roofing nails, 5 packets	0	5	0
Screws and washers	0	0	6
Painting and oiling.—Before erection, 14 gals. oil (linseed, raw)	2	10	0
84 lb. white lead	1	3	6
After erection, 5 gals. oil	0	17	6
1 cwt. white lead	1	10	0
Elevator.—Link belting and sprocket wheels	6	5	0
Take-ups	2	0	0
Labour.—Carpenter, £10 9s. 6d. ; labourer, £2 15s. ; painter (when erected), £1 19s.	15	3	6
Estimated value of Mr. Percival's labour	7	0	0
Sundries.—Nails, 18s. 9d. ; staples, 1s. 9d. ; bolts, 1s. 6d.	1	2	0
Freight on timber, £2 7s. 1d. ; cartage on timber (6 tons), 17s. 6d. ...	3	4	7
Rope for scaffolding	0	5	0
	£100	9	6

No amount has been charged for scaffolding, as the poles were borrowed and afterwards returned.

* The timber which was used for bracing, &c., afterwards used in the construction of the roof.

Building the Silo.—The foundation was prepared by halving two of the long logs together at their centres and at right-angles to each other. Short logs were then fitted into the angles and equi-distant from the long logs. After tarring them, the whole was firmly spiked together. The slabs for the kerbing were then mitred on the tops of the logs, and after being tarred they were spiked down. The position for the kerbing was determined, by marking the inside size of the silo on the tops of the logs, by means of a batten revolving on a nail fixed in the centre of the foundation, and set to describe a circle (radius, 9 feet), to correspond with the circumference of the silo. The inside edge of the kerb was then set about 1 inch on the inside of this mark. After the kerb was in position the inside circumference of the silo was marked out on it by the aid of the batten previously mentioned. In Fig. 1 will be found an illustration of the foundation as it appeared when completed, and when ready for the door-frame and staves.

Fig. 1.—The foundation ready for the erection of the door-frame and staves.

The door-frame was then prepared. This was so designed that there would be a continuous opening from top to bottom of the silo, thus when emptying the silo, the lifting is reduced to a minimum, and the exposure and consequent waste of the face of the silage done away with. This doorway has proved perfectly satisfactory. It is extremely simple in construction. Two pieces of 6 in. x 4 in. hardwood are held together at the required distance, 2 feet apart by nine inch round iron-bars. Each end of the bars is threaded and fitted with two nuts. One nut is placed on the inside of the door-frame, and acts as a shoulder to keep the sides the required distance apart; the other nut is on the outside of the frame, and keeps the sides from spreading. Both sides of each piece are checked or rabbited 1 inch deep on the inside edge—on one side to receive the staves and on the other side to receive the door boards, and so prevent them falling out of the silo. These door boards are pieces of Oregon, 2 feet long, 12 inches wide, and 2½ inches thick. They are placed on edge in the frame as the filling of the silo goes on, and are kept in position by the pressure of the greenstuff against them. In

order to exclude the air more thoroughly, they are covered with building paper, which is unrolled upwards as the filling proceeds.

If the silo is not to be an eyesore, it is very essential that this door-frame should be placed perfectly upright both ways, and then securely braced or stayed until the hoops on the silo are screwed up tightly. Unless this be done the silo

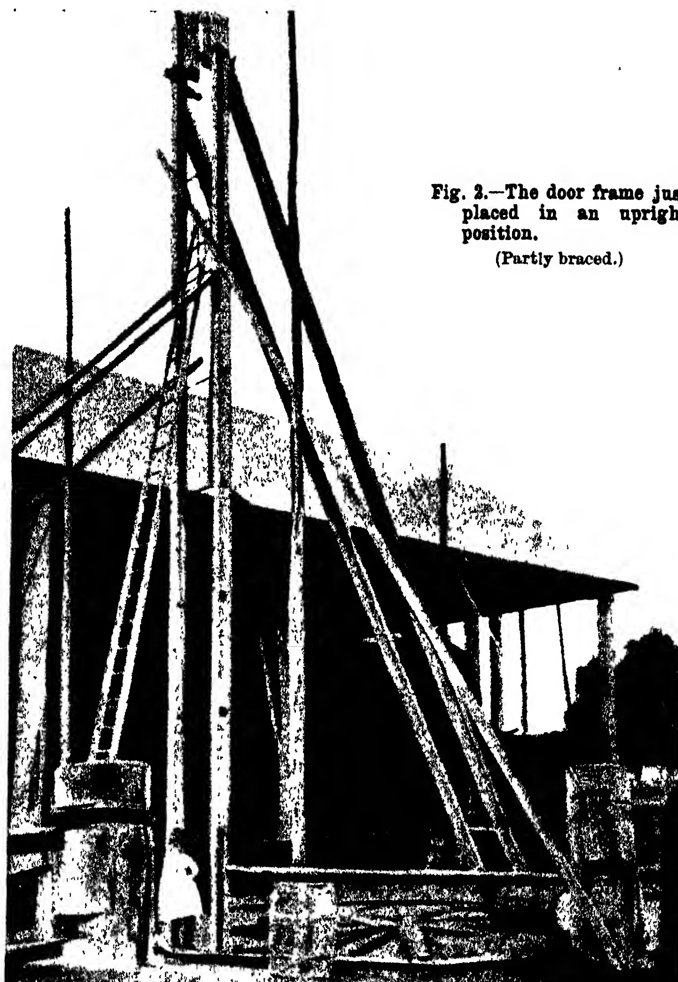


Fig. 2.—The door frame just placed in an upright position.
(Partly braced.)

is likely to be anything but plumb. If this door-frame, when completed, is not placed perfectly upright, the difficulty of erecting the staves is greatly increased, or if it is allowed to get out of "plumb" before the hoops are tightened, the whole structure is more than likely to have a serious list.

The door-frame having been erected and *braced*, the scaffolding was put up. This consisted of six poles, fixed into cement casks with sand, and placed

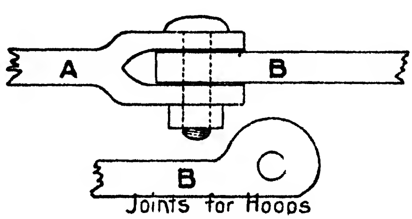
around the silo. To these poles were lashed two tiers of cross-poles on which were rested planks for the workmen to walk upon as the building proceeded. Attention here ought to be drawn to the hanging ladder shown in Fig. 5; but for this, the scaffolding would have had to be much more massive and elaborate. By the aid of this hanging ladder the workman was able to clamp

Fig. 3. -The door frame securely braced in position.
(The scaffolding completed.)

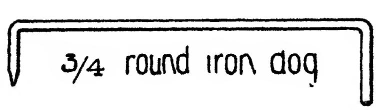
and nail the staves at the top of the silo. Fig. 3 shows the door-frame in position and securely braced ready for the staves to be erected, also the scaffolding completed.

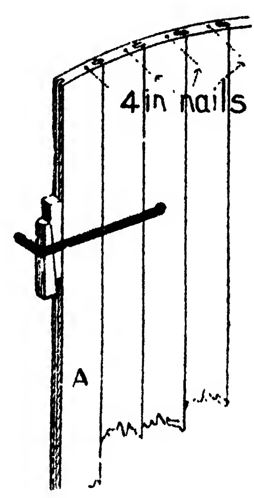
The erection of the staves was next proceeded with. The staves had previously been painted outside and on the edges with white lead and oil, and

had been oiled (linseed) on the inside after the edges had received a second coat of paint. The staves were raised by means of a rope. The bottom was placed in its position to the circle previously marked on the kerb. It was then drawn up tightly to the adjacent stave by means of wedges and a "dog" (similar to the one designed by Mr. A. Brooks, Hawkesbury Agricultural College). It was fastened with a 3-inch nail to the kerb, and with a 4-inch nail to the top of the adjacent stave. If required, it was skew-nailed at various places on the edge. The slip tongue was painted and then inserted ready for the next stave. The staves were erected in batches of six, first on one side of the doorway and then on the other side. The last stave to be erected is almost exactly opposite the doorway. As might be expected, the staves were at first erected slowly and with difficulty; but as experience and confidence were gained, they were erected more speedily. The whole of one-half day was occupied by three men in erecting six staves, at rate of twelve



Plan of hoop-joints.





Showing dog in use,
A being the bent plank.

per day; the next day sixteen were erected; and on the third day twenty-four staves were placed in position. The illustration (Fig. 4) shows that two batches of staves have been erected, viz., one batch (*i.e.*, six staves) on each side of the doorway; the third batch is being erected.

Every sixth stave was plumbed, and then temporarily stayed.

When all the staves were erected the hoops were put on. The hoops are made of ¾-inch round iron; each one is in five lengths, 11 ft. 4 in. long, which are fastened together with hinge-joints. (See illustration.) The hoops were bent to the required shape by hammering each section on a wooden block, which had been hollowed out to correspond to the approximate curvature of the silo. The ends were tapped for a distance of 8 inches; this allowed for the joints between the staves being made considerably tighter after the staves were erected.

On making a start to put the top hoop in its position, it was found that the staves were not close enough together to allow the ends of the hoop to project through the sides of the door-frame. It was therefore necessary to temporarily lengthen two of the hoops, in order that the staves might be drawn together close enough to allow the permanent hoops to be put on.

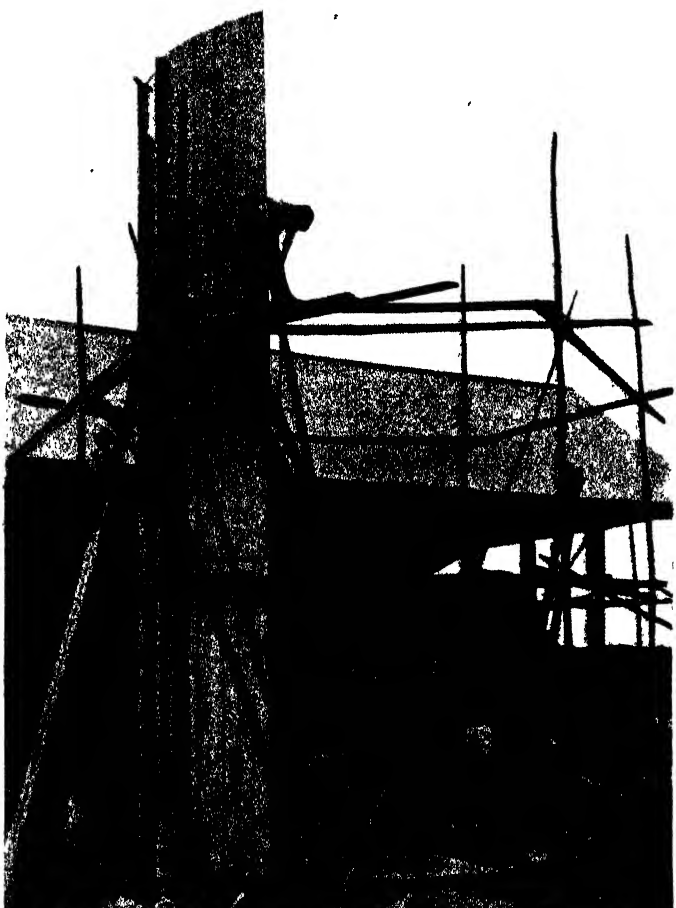


Fig. 4.—The putting-up of the staves.
(The third batch of six staves is now being put up.)

These hoops were lengthened by inserting short pieces of chain at one of the joints. With the aid of these lengthened hoops, the staves were soon pulled together and a permanent hoop put on. (See Fig. 5.) After the hoops had been put on, and when they had been screwed up enough to get a grip of the building, the nails which held the bottoms of the staves to the kerbing were withdrawn, and the stays which were holding every sixth stave in position

were removed, in order that the silo could be tightened up regularly and evenly. When the silo was thoroughly tightened, and *not before*, the stays and braces holding the door-frame in position were taken away.

The framing of the roof was then proceeded with. The roof is pyramidical in form. The wall-plates—eight in number—were placed at regular distances around the silo. Each one is shaped in the middle to fit the round of the

Fig. 5.—Ready for the permanent hoops.

(Notice the chains at the joints which temporarily lengthened the hoops, so that the staves might be tightened sufficiently for the permanent hoops to be put on.)

silo, and is bolted there to one of the staves. The ends are supported by brackets, which rest upon other staves (Fig. 6). From each wall-plate is built a section, similarly constructed to the hip-roof of a cottage. The main rafters meet at an octagonal pinnacle or king-post. The roof is covered with corrugated galvanised iron.

In order to prevent a misapprehension which is known to be held by some, it is advisable to state here that, in fitting the iron to the roof, there was

no waste of material; the pieces cut off the sheets to fit them to one side of the hip were required and were used for the other side of it.

In order to admit the end of the elevator above the top of the staves (this is necessary if the silo is to be completely filled), a sheet of iron has to be removed from the roof. This is decidedly inconvenient; the necessity for it can be obviated by building, as suggested by Mr. Percival, a small dormer-window in the roof, just over the door-frame.

Fig. 6.—Putting on the roof.

(Notice the brackets supporting the ends of the wall plates.)

Finally, the outside was given a coat (the second one) of white lead and oil; the elevator was placed in position, and the silo was ready to receive and preserve its contents until they were required. (Fig. 7.)

Having stood the storm and stress of the last two and a half years, the building is in excellent condition, and no worse for the good service it has done. This satisfactory state of affairs must largely be ascribed to the treatment which Mr. Percival gave the timber, to counteract those influences

which encourage destruction and decay. The necessity for this treatment cannot be too strongly emphasised. It must be remembered that the timber in a silo is subjected to exceptional and severe strains. The inside at one time (when empty) is subjected to heat and dryness, at other times (when full) to heat and moisture, and the outside has the variations and extremes of our trying climate to contend against. Too much care cannot, therefore, be bestowed upon the preservation of the timber used in the construction of these

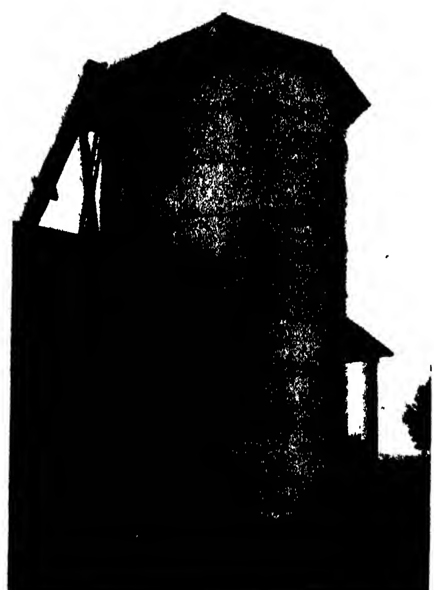


Fig. 7.—The completed Silo—partly filled.

(On the right hand side of the door-way are the boards used for closing up the door-way as the filling proceeds.)

buildings. I feel sure that the success which will accompany the use of this type of silo will largely depend upon the care taken to preserve the material, especially the wood used in its construction.

Has it paid? The best answer to this question is the fact that the owner is arranging to build another and a larger one, for the time has now arrived when a silo is no longer only a *convenience*, but is a *necessity* to an up-to-date dairyman.

Botanical Notes.

J. H. MAIDEN,
Government Botanist.

The Spread of the Noogoora Burr.

This is *Xanthium strumarium*, Linn. See the *Gazette* for October, 1899. It is one of the worst weeds that has invaded New South Wales in recent years; the rivers are spreading it rapidly. Following is an extract from a letter by Mr. F. P. Sölling, of Moree, to Mr. C. J. McMaster, Chairman of the Western Lands Commission:—

"I send you a specimen of 'Noogoora burr,' which has now lined the rivers and water-courses since the drought. It grows chiefly along the river, although at times you may notice large bushes of it growing away from the water-courses."

A Native Plant recommended as a Fodder for the Dry Country.

Its botanical name is *Sida corrugata*, Lindl., variety *trichopoda*. It is a native of the drier parts of most of the Australian States, and is of very wide distribution. The following interesting letter concerning it is from Mr. F. P. Sölling, of Eri Eriwah, Moree, to Mr. C. J. McMaster, Chairman of the Western Lands Commission. It is apparently new to the country of which Mr. Sölling speaks, or, rather, it had been lying low until quite recently. The best of all fodder-plants for the dry west are the native ones, for they have acclimatised themselves during the ages to Australian conditions. Just at the present time, the conditions of moisture and climatic conditions generally are favourable to its spread and development. They will not always be favourable to this particular plant, which will die down in due course, and (we hope) be succeeded by other useful fodders.

"I first noticed this new shrub at Bugilbone and Yarraldool; and some of the paddocks at those places, when the February rains came, had the appearance of lucerne patches, but covered with yellow five-petal flowers, flat, and of the size of a threepenny-piece. The shrub I found scattered over a wide area of country, more in some places than others. I noticed it growing on the Castlereagh, the Marthaguy, the Macquarie, and up the Barwon, chiefly out back, quantities of it on places like Mercadool and Merrywinebone, and in places, *vid* Goonal, right through to Moree. Mr. Watt tells me that this is the first year it has been seen on Goonal.

"The plant is a distinct shrub, growing something in the way of a cotton-bush, but more of the appearance of a thick-growing single lucerne root, and, like lucerne, has a very large, deep down tap-root. It sprouts out profusely from the top of tap-root, and closely cropped-back woody branches, with every shower of rain; and, I am told, grows chiefly in winter, although I saw it, at its best, during the February and March rains period, when it was covered with yellow flowers, and shortly afterwards a most prolific crop of seed was in evidence. The shrub or herbage is a perennial, and several of the settlement lessees about Walgett have told me that it is now the best kind of herbage they have—that it is very fattening and that sheep fatten very quickly upon it. Cattle also seem to be fond of it, but horses do not care much for it. On my return from Walgett I looked for it on the island and found odd small bunches of it."

"What I have seen of it induced me to gather a bag of it, and I am sowing it in all my paddocks with a view of increasing their grazing capacity."

Farmers' Fowls.

[Continued from page 488.]

G. BRADSHAW.

Chapter XXXIX.

Location.

Having dealt exhaustively with all the breeds considered suitable for the farm, attention will now be given to where and how fowls should be kept, and without further introduction, I may say that the agricultural farm of all places is the ideal one for profitable poultry-breeding. Farms devoted to the sole purpose of breeding fowls for their carcase and eggs, and having to pay rent, taxes, wages, feed, and a number of other expenses, are very rarely a success, and such establishments I warn all to eschew, the many failures of such being largely responsible for the too frequent detracting phrase applied to the industry, namely, "It won't pay." That there are farms devoted solely to the production of eggs and meat, and from which a living, more or less satisfactory, is being made, I freely admit; but each of these has some special advantage in procuring much of the fowls' food at other than market rates. Hotels, restaurants, and boarding-houses are daily visited by some of these breeders, loads of excellent fowls' food being obtained from such places for a trifle beyond that of the carting of it away. Glebe Island also supplies tons of stuff weekly, which, when prepared and cooked, has properties excellent for egg-production. The wharfs and flour-mills are also exploited for occasional cheap lines, all assisting to make this class of poultry-farming a paying one. However, with the above advantages, which are only available to those within easy distance of the city, there are many detracting features. On farms where no other stock are kept, poultry have to be bred in immense numbers to return a profit. The business of cooking, cleaning, feeding, and otherwise attending to these large numbers is not of the pleasantest, for, no matter how clean the place may be kept, or how sanitary the arrangements, disease will in time make its appearance, and to dose and doctor a number of roupy fowls with a prospect of curing is a disagreeable experience. Then there are all the disappointments in hatching, the mysterious dying of large numbers of well-cared-for chickens, and at times unsatisfactory markets, are but a few of the handicaps.

There are no eight-hour days on a poultry farm; from daylight to dark in summer, while in the winter many hours have to be spent after sunset over the thousand and one things connected with a large poultry plant, and of all other businesses this one is that of seven days in the week; indeed, those whose lives are cast in such places are all eloquent on the hardships inseparable from the calling.

Another variety of poultry-farming, and more satisfactory, with less unpleasantness, is that of the poultry fancier. This comes about by the purchasing of one or more pens of high-class pure-bred fowls of some popular breed, if good enough to exhibit and occasionally win. There is, with judicious advertising, a considerable sale of eggs for hatching, and in season a demand for pure-bred birds at prices considerably beyond that of the ordinary market sort. This branch of the poultry business is carried on to a considerable extent in the suburbs of Sydney, those who go in for this branch being usually people who are in business in the city, and to many at the present time it affords a considerable adjunct to their ordinary wage or salary, while in more than one known instance the sale of stock and eggs so increased that the owner gave up his legitimate calling, and confines himself to the breeding of fancy fowls only. Several at the present time are doing fairly well at this branch; but, taken as a whole, the fancy requires some side issue to assist it.

That other branch of the industry—poultry on the farm—is the chief object of these articles, and whatever the handicaps to profitable breeding, as shown above, the keeping of fowls on a farm is subject to none, and is the most pleasant part of the business to write of, for no matter what way the subject is looked at, we must come to the conclusion that the agriculturist, of all others, is the man who can and should make poultry-breeding a profitable undertaking. He has the land, for which he pays no rent for the fowls, the looking after them is within his own family, while for food, no matter what crops may be grown, there is always waste—unmarketable cereals, roots, &c.—which actually cost nothing, and can be profitably fed to the fowls. Then the fowls on a farm usually have a free range, and gather up large quantities of natural food, such as weeds, seeds, and numberless insects, all of which contribute to healthy and cheaply-fed fowls. Poultry keeping on a farm can be carried on at a minimum cost, and this despite the fact that the location may be far removed from the Sydney markets.

In an earlier portion of these articles, I showed that we got our birds from England, and judged them at the shows in accordance with the English standard, a feature to which none care to take exception. We, however, do more than that; we get the bulk of our poultry books and poultry literature from the same source, and, unfortunately for ourselves, slavishly follow the advice given therein as to management, forgetful of the fact that the climatic and other conditions are so different that what might be the correct thing for the cold, damp climate of the United Kingdom would be altogether unsuitable for this semi-tropical country.

In connection with location, we are told to select a high, dry place for the fowl-runs, that they must be well drained, and face a certain point of the compass, while for houses, the sort advocated and approved of for English conditions are, in many instances, copied here and with disastrous results; an illustration will suffice. Not long since, I visited

what was termed an up-to-date poultry farm, devoted solely to the fancy side of the industry. The holding was, perhaps, 20 acres, and embraced a high, dry, cleared paddock, minus even a solitary tree, the soil, or rather earth, being of a hard clayey nature. This extended down to a very low ground with trees and much undergrowth, with a magnificent soft surface, composed of the organic remains and other débris washed from the higher ground by the centuries of storms. The reputed model poultry plant was built according to English ideas, on the high, dry, hard hill, the runs extensive enough, but not a leaf of shade, nor a blade of grass; while the expensive and well-built, but ill-ventilated, houses had a temperature on the day of my visit equal to that of an English hot-house or a gardener's forcing frame,—conditions which were certainly responsible for the peculiar noise then being made by many of the fowls, true symptoms of a cold, and forerunner of the frequently fatal roup. These prize fowls when fed in the morning, although having plenty of space, had no occupation or inducement to wander on this selected high and dry place, and just squatted down throughout most of the day waiting for their next meal, and following that, another dreaded night in stuffy sleeping quarters. This was the week in, week out life of these prize fowls in these prize poultry yards, on which one-tenth of the money spent would have given better results. The one and great mistake was the too faithful adherence to the conditions obtaining in other countries, and particularly to the high, dry, and well drained bogey. I have to add that the farm, as a whole, was an ideal one for the purpose of the owner, *i.e.*, keeping in health, breeding and rearing prize fowls, which would have obtained had the owner erected the houses half-way down the hill, spent less money on their architecture, and extended the runs right down into the lowest portion of the ground, enclosing the low land with its deep, black, soft soil, the trees, bush, and other growth, leaves, &c., these harbour myriads of insects and other of Nature's foods, and affording that great essential to fowls' health—scratching exercise—and thus prompting a better egg production. Shade, also, would be afforded, an important element in this country of perpetual sunshine. Had this portion of the farm been given to the fowls, their life would have been a more natural one, for, despite the fact of supplied foods, centuries of domestication has not yet deprived fowls of their instinct of scratching for a living, this contributing to their contentment and beneficial to their welfare in many ways. When the above was suggested to the proprietor, he replied that Lewis Wright said so-and-so, forgetful of the fact that that authority was never in Australia. It was evidently not apparent to the designer of the plant that there was nothing to drain, and even in the lower portion referred to, a couple of inches of rain in twenty-four hours, although beneficial, would not be visible; indeed, were there a 6-inch fall in one week on any of our suburban poultry farms, such, although inconvenient at the time, would have other than ill-effect. In relation to the high, dry, and well drained theory, such is certainly applicable to

England, with its 250 or more wet, sunless days in the year, and where frequently the roadway is not dry for three autumn and sometimes the three spring months of the year. The soil, whether of poultry or other farms, is mostly wet and cold; while for houses in a country where wind, rain, sleet, snow, hail, and frost obtain so many days in the year, and the sun shines on so few, such cannot be too comfortably constructed. The poultry-farmer and poultry-keeper in Australia is more highly favoured by natural conditions than in almost any other country in the world, the simplest possible structure, to keep off the occasional tropical showers, and a breakwind of some sort, being the only requisites for housing in a large portion of the State; and there are numerous instances of profitable poultry keeping where the birds are allowed to roost on trees or fences, and sometimes prize-winners at that. In a case of my own, at Randwick, three years a hen hatched eleven chickens in a corner of the garden, no overhead covering whatever, the only protection being a paling fence on two sides and some garden growth in front. During the hatching period over an inch of rain fell in fourteen days; the eggs were coated with the wet soil after rain, still eleven were hatched out of the thirteen. The hen had full liberty with the chickens, brooding them wherever she liked, but never under any constructed covering, and at nine or ten weeks took them into a lemon tree to roost, and, when at about 3 months old, over 1½ inches of rain fell in one night, without apparent ill-effect. During the period, one chicken disappeared; the remaining ten were reared by the hen, one of these being exhibited at the following Royal Agricultural Show at Moore Park, in the same class as his imported sire, the latter highly-pampered oversea aristocrat having to take second place to the Australian native, bred and reared under open-air conditions, his only covering being the Australian sky. On two subsequent occasions the native bred distinguished himself in the same way, and several of the other sex in the same brood grew to be bigger and better exhibition specimens than their English-bred and far-travelled matron.

It must be here distinctly stated that I have no intention of advocating the above open-air sort of poultry keeping, the purpose being rather to show that such results would be utterly impossible in England or America, and that when the success noted was achieved here, still better results must be expected where dry overhead conditions obtain. The above experience was in respect to the rearing only; but that the very best results can also be obtained in egg production by simple methods in housing and feeding is also overwhelmingly proved, as will be seen in the *Gazette*, June, 1906, where, at the Rockdale egg-laying competition, where everything as regards housing, appliances, and feeding was simplicity and cheapness itself, 300 Australian-bred hens, of different breeds and varieties, made a world's record by laying the grand total of 58,736 eggs in the twelve months, or slightly over 195 for each hen.

(To be continued.)

Report on Crops Grown from Seed supplied by the Department of Agriculture, 1905-6.

Grown at Cathcart Public School Experimental Farm, Monaro District.

D. C. SULLIVAN, Teacher.

Weather.

THE rainfall for the period under review is as follows:—

April, 174 points.	August, 29 points.	December, 269 points.
May, 163 "	September, 29 "	January, 43 "
June, 130 "	October, 511 "	February, 69 "
July, 139 "	November, 37 "	March, 750 "

The months of August and September were very windy and dry, while the month of October was unusually cold and wet. The heaviest falls of snow experienced here for many years fell on the 20th and 27th of October. The months of January and February were dry and unusually hot. The weather prevailing during January and February rapidly carried away the surface-soil moisture. No useful rain fell during January or February. I received a miscellaneous collection of seeds from your Department in March and April last year.

Wheats.

The following wheats were grown:—John Brown, Bobs, Sussex, Red Manitoba, Tarragon, and Jonathan. They were planted on the 8th May, the area allotted each variety being 40 square yards. Yields from each were good. The Sussex, John Brown, and Red Manitoba gave by far the best yield. The heads in all cases were from 4 to 6 inches in length, well filled with clean, large, and well-formed grain. It was reaped on the 23rd January. My experience has shown me that April or May is the best time to sow wheat. June and July are not suitable months here, as a rule. I sowed some in June, July, and August. That sown in June and July did not come up. That sown in August did fairly well.

Maize.

The following varieties were sown on the 12th October, viz.:—Tuscarora, Early Leaming, Pride of the North, Clarence River Wonder, and a variety of Ninety Day.

As has already been remarked, the month of October was very cold and wet, nor was any spell of warm weather experienced till the middle of December; consequently there was not sufficient warmth for the maize to make much headway in the early stages of its growth. The very hot dry weather of January and February, when the maize was cobbing, checked the growth and development of the cobs. We really had no spring, but

went from winter to summer at a bound. All kinds of maize were stunted. There was a fair amount of cobs, but the grain was rather pinched and the cobs small.

I am convinced that maize-growing for market will not be successful unless some early variety can be introduced. For the purpose of green fodder and ensilage, however, it can be grown successfully.

Millets.

The Japanese and Hungarian varieties were grown very successfully with good results, especially the former. Japanese millet appears to be an excellent fodder plant and easily grown. The broom millet and sorghums were not a success this year.

Lucerne.

I had a teaspoonful of seed of the Hunter River broad-leaf variety given me, and the result was highly gratifying. It grew very well. I cut a bunch for the Bombala Show, where it excited the surprise of those who knew the school locality and the character of the soil. To grow it successfully the ground should be deeply ploughed. Several farmers talk of trying it this season.

Grasses.

The following grasses were grown this year with great success in every instance :—Blue Texas, Sheep's Burnet, Cocksfoot, Rye (Poverty Bay and Perennial), Perennial Red Clover, Weeping Love, Buffalo, Rhodes, and *Paspalum dilatatum*. The clover was quite 2 feet high. Blue Texas is a splendid grass for this locality, being a quick and vigorous grower, growing best after the second year. The Rhodes grass and the Paspalum are affected by the frost. The former will stand light frost fairly well. It is a picture in the months when all the natural grasses are browned with the sun. Sheep's Burnet stands the drought well, being deep-rooted.

Vegetables.

The following varieties of pumpkins were grown, viz. :—Ironbark, Crown, and Button. They are rather late, but the vines are healthy and fruiting well, but I am afraid they will be too late, unless the frost keeps off. The Hubbard squashes were grown, yielding fine fruit.

Cucumbers.

These were killed by the hot weather of January and February.

Beans.

Canadian Wonder, Climbing French Beans, Scarlet Runner, Dwarf, Golden Butter Bean, were tried with success. Some fine pods were grown and exhibited at the Bombala Show. The Canadian Wonder gives best results.

Peas.

The following were sown :—American Wonder, William Hurst, Sherwood. I can recommend the Sherwood as a good vigorous grower, with large well-filled pods. The two former were not a success, the pods being small and the seed pinched. The Daisy pea is better than either of the three above mentioned.

Parsnips.

The Hollow Crown were grown and did very well.

Carrots.

The Early Shorthorn gave best results.

Strawberries.

Jesmond, Royal Sovereign, Marguerite, and Mammoth varieties were grown and bore fine large fruit, but the ants proved very troublesome.

Onions.

The Brown Spanish and Potato onions were grown and good results were obtained in each case.

Swedes.

I tried Purple-top, Sutton's Champion, and Magnum Bonum, and got very fair results. The Purple-top variety were easily first.

Beet.

Red (turnip-rooted) and Silver beet were grown, and gave excellent results, some of the finest Silver beet I ever saw being produced. Plants of both kinds were given to neighbours and some fine samples were obtained.

Cabbage.

This year I tried seven varieties, viz.:—Danish Ball Head, Burpees, Succession, St. John's Day, Early York, Drumhead Savoy, Henderson's Early, and got good results compared with other farmers round about. I got best results from Succession. St. John's Day came next. This year I am trying two other varieties—Schweinfurt and Flat Dutch.

Rape.

I sowed a bed of Essex variety on the 1st of February and got a fine crop. This plant is now being grown by farmers as a fodder plant.

Sunflower.

The Russian sunflower was sown and some very fine seeds obtained.

Tomatoes.

Were also planted, and though bearing well are too late to do much good.

Cape Gooseberries.

Have been tried this year, and the plants are fine and healthy and just flowering, but will be too late.

I have also recently planted cowpeas and tares for green manure. The manure used this year has been chiefly farmyard manure and decayed leaves from compost heap.

I have to acknowledge gifts of seeds and plants from Messrs. Anderson & Co. and P. L. C. Shepherd and Son.

Had it not been for continual cultivation during the year, I am fully convinced the results would not have been so satisfactory.

I am trying flax this year for seed and fibre.

GROWN AT PIPECLAY SPRING PUBLIC SCHOOL EXPERIMENTAL GARDEN, MONARO DISTRICT (4 MILES FROM BOMBALA).

G. P. FITZGIBBON, Teacher.

SOIL—a clay-loam; deep, but sour. Situation—a gully flat, subject to flood until drained. Digging—commenced in July, 1905. Draining—completed in same month. Manuring—no manure applied to seeds sent by Department until this month (March, 1906), when light dressings of horse and cow dung were given to rape and lucerne beds.

Tabulated Results.

Weather.

December, January, and February, no rain. September, October, November, normal. March, very wet.

*Wheats.**

Bobs—planted 18th September, 1905; part dry, and part soaked in bluestone solution. Stem—of medium length, clean and bright. Grain—pinched, but otherwise clean and sound. Approximate crop—about 18 bushels to acre. (Proportionate calculations.)

Plover—planted 18th September also; part dry and part soaked. Stem—medium length, clean, and of good colour. Grain—pinched and poor. Crop—about 10 bushels to acre.

John Brown—planted 18th September; part dry and part soaked. Stem—excellent length, clean and bright. Grain—a bit pinched, but still of fair quality. Crop—about 25 bushels to acre.

Oats.

Twentieth Century—planted 19th September, 1905. Stem—medium, clean, and of good colour. Grain—small and light. Hay—of fair quality.

Colossal—planted 19th Septemper, 1905. Stem, grain, and hay—differing in almost nothing from those of Twentieth Century.

Barley.

Skinless—planted on 20th September, 1905. Stem—short, and very clean. Grain—large and heavy; heads short and thick. Crop—fully 40 bushels to acre. Made no hay.

Flax.†

Sown 20th September, 1905. Stem—about 2¾ feet in length when pulled; bright and fine. Heads branchless, short, but well seeded. Seed—about 12 bushels to acre; well-filled and clean.

* No apparent difference between steeped and dry grain in any variety. A continued spell of dry weather considerably interfered with wheat results. The sourness of soil had an injurious effect also.

† Considering the lateness of sowing, the crop was exceptionally good. The ground being only a week or so dug before sowing seed was a further drawback. For instruction purposes, I have retted and fibred some of stem, and find the fibre of a fine texture, but short—12 to 14 inches. This crop should well suit this district.

Hemp.

Sowed twice—first on 21st September, 1905, and again on receipt of second packet of seed from your Department (on 14th December, 1905). Both sowings failed totally.

Maize.

Early Red Hogan.—Planted 9th November, 1905. So far, this variety looks fairly well. It has cobbed well, and the grain is apparently filling fairly. The stalk is low (about 4½ feet high), but healthy and hardy. In its present condition it should make good ensilage.

The other varieties rotted in the ground, in similar soil and with similar treatment. Seeds germinated, but did not come through the surface. Have never had similar experience.

Sorghums.

Early Amber.—Planted 8th November, 1905. Stalks at time of writing 4½ feet high, of splendid stem and rich leaf. No appearance of seeding yet.

Planter's Friend.—Not so high as Early Amber, but sturdy and improving since late rains.

Saccharatum.—About the same as Planter's Friend.

Lucerne.

A bit slow in growth. (Planted 20th September, 1905.) First crop, long and delicate, but the second growth is rich and thick. Fully 10 inches growth in past fortnight.

Rape.

Early sowing (in October early) stunted and poor. A later sowing in January looks capital; nearly 2 feet high, and of good and plentiful leaf.

This should make a capital crop for winter feed here.

Mangold Wurzels.

Long Red.—Planted 18th September. Of good size and looking well.

Golden Tankard.—Planted 20th September. Of good size, and looking well.

Yellow Globe.—Planted 14th November. Of extra size and vigorous.

This last variety seems best adapted to local soil, &c.

Sugar Beets.

Vilmorin White.—Planted 14th November. A good crop so far.

Klein Wanzleben, &c.—Planted 20th September. Not so good as above; still, fair.

A further report on maize, rape, mangolds, beets, &c., will be forwarded when final results can be calculated, and effects of winter frosts and snow noted.

Cabbage.

Seeds sown 30th January (winter fodder variety). Young plants look vigorous in the plant-bed. Some planted out in garden are growing well thus far.

Grasses.

Natal Red-top.—Planted first week in November, 1905. Only a few seeds germinated, but these have produced stalks of wonderful richness and succulence. Should, when acclimatised, be a good grass for district.

Rhodes Grass.—As with Natal Red-top, only a few plants have resulted from sowing, but these have already spread over a large area. Bunches root at every joint. It is rather easily pulled from the ground, and—the first year, at least—would be unsuitable for feeding off ground.

Paspalum dilatatum.—Every seed germinated, and bed looks exceptionally well. The plants are not high, but well spread.

Paspalum virgatum.—A total failure, with same treatment and like soil.

Sheep's Fescue.—A failure also.

Poverty Bay Rye Grass.—A splendid crop, long and rich.

Prairie Grass.—A fair crop; a good many of seed-tops were smutty. This grass is plentiful locally.

Timothy and Cocksfoot.—Both partial failures. Those plants that have grown are strong and of good height.

Meadow Foxtail.—Delicate, and not inclined to stool.

Meadow Fescue.—A beautiful crop; solid and bunchy plants.

Of above grasses, the Poverty Bay Rye, Meadow Fescue, and *Paspalum dilatatum* seem best adapted for locality. The Paspalum looks as if the frost would have a more injurious effect on it than on the others, however.

I am preparing a bed to test the spreading powers of Rhodes Grass.

A later report on grasses under winter conditions will be forwarded.

Clovers.

Alsike.—Low, but strong and improving.

Perennial Red.—Rich and high; an excellent crop.

Crimson.—Thin, but still a fair crop.

Clovers planted 7th November, 1905.

I have sown within present month, for winter observations, wheat (John Brown), Skinless barley, Colossal oats, flax, hemp (seed got locally), bird-seed, and rape. Have lightly-manured rape, and intend giving the varieties of wheat and oats a chance next season in better-prepared beds.

Grown at Toothdale Public School Experimental Farm.

J. A. BROWN, Teacher.

20 Sept.—Sowed Mauritius bean; germination, 25 per cent.; up above ground in 30 days; growth rather slow owing to adverse season.

20 Sept.—Planted arrowroot; up above ground in 20 days; growth rapid; now (5th March, 1906) 3 feet high; very good growth considering dry season; expect a good return.

29 Sept.—Sowed new Siberian millet in rows; germination, 100 per cent.; growth good.

22 Sept.—Sowed cowpea "upright" in rows; germination, 30 per cent.; up above ground in 11 days; growth good.

22 Sept.—Sowed canary seed in rows; germination, 100 per cent.; up above ground in 8 days; growth excellent; harvested, 25th January, 1906.

22 Sept.—Sowed flax seed in rows; germination, 90 per cent.; up above ground in 8 days; growth excellent; harvested seed, 1st February, 1906.

22 Sept.—Made three successive sowings; but germination was very bad, viz., 1 per cent., and these do not appear to thrive, notwithstanding the care taken of them.

22 Sept.—Sowed hemp seed (imported) in rows; did not germinate, although three successive sowings were made.

22 Sept.—Sowed evergreen millet (imported seed) in rows; although three successive sowings were made, germination did not take place.

5 Oct.—Sowed new haricot bean in rows; germination, 70 per cent.; up above ground in 14 days; growth good; harvested, 17th February, 1906; yield good.

5 Oct.—Sowed Whip-poor-Will cowpea; germination, 20 per cent.; up above ground in 14 days; growth good.

5 Oct.—Sowed white-seeded cowpea in rows; germination, 40 per cent.; up above ground in 14 days; growth good.

6 Oct.—Sowed cowpea, "black seed," in rows; germination, 30 per cent.; growth good.

6 Oct.—Sowed cowpea, "clay coloured," in rows; germination, 30 per cent.; growth very fair.

6 Oct.—Sowed White French millet in rows; germination, 100 per cent.; growth good; up in 8 days.

6 Oct.—Sowed New Siberian millet; germination, 100 per cent.; up above ground in 8 days; growth very fair.

6 Oct.—Sowed Pearl millet in rows; germination, 50 per cent.; growth fair.

7 Oct.—Sowed Teosinte in rows; germination, 70 per cent.; up above ground in 8 days; growth slow.

7 Oct.—White Italian millet in rows; germination, 90 per cent.; growth very fair.

15 Nov.—Sowed beans, "Sutton's Perfection," in rows; germination, 60 per cent.; growth good. This is a good bean.

28 Nov.—Sowed Hungarian millet in rows; germination, 100 per cent.; up above ground in 7 days; growth good. We made excellent hay of this, of which stock were very fond. I would strongly recommend it for this purpose.

1 Dec.—Sowed new pumpkins—Essex hybrid; germination, 100 per cent.; up above ground in 6 days; growth, considering unfavourable season, very satisfactory.

In summing up, I must say the season from 1st September, 1905, up to the 28th February, 1906, has been rather an adverse one. In fact, all crops were thrown fully a month to five weeks back owing to the sudden cold weather that set in during the middle of November and continued for some time. Plants that were well above ground and beginning to thrive at this time, were almost completely cut off by the sudden cold changes.

All the plants grown from seeds, as reported above, appear to do well here, excepting "jute." Sorghums, millets, roots of all kinds, beans and peas of kinds, pumpkins, melons, cucumbers, cabbage, lettuce, oats, barley, rye, wheat, maize, tomatoes, onions, sainfoin, sheep's burnet, pea-nuts, grasses, such as paspalum, Rhodes grass, Kentucky Blue grass, &c. All do well here under proper treatment.

Grown at Public School Experimental Farm, Clairville, near Glen Innes.

W. F. HISCOCK, Teacher.

Among the crops with which experiments were made at this school were:— Maize, 12 varieties; millet, 4 varieties; sorghum, 4 varieties; cotton, 3 varieties; cowpeas, 5; field peas, 2; broom millet, teosinte, pearl millet, sugar beet, rape, lentils; sunflower, 3; and potatoes, 10.

At the time of sowing most of the seeds the weather was unfavourable; so greatly so that mustard, hemp, tobacco, flax, and numerous grasses failed to germinate, or perished very soon after germinating. The land on which tests were made was new, broken up for the first time a few days before planting, and being of a heavy clay-like composition, required liming, which, however, was not done.

Maize.—All the varieties of maize were sown late in the season (8th November), and the weather being dry and the soil in a rather rough state, the young plants grew slowly. The white kinds were more prolific, and matured earlier than the red or golden sorts, with the exception of Ninety Day. Of the white varieties, Iowa Silvermine gave best results, but was approached closely by Hickory King, and Early White did satisfactorily.

Ninety Day came to maturity very early and cobbed plentifully, but the grain proved shallow and lacking in meal. Riley's Favourite, Golden Beauty, and Golden King gave best results among the golden classes, but owing to being sown late, the season was rather short for their thorough maturity. Horsetooth and Early Leaming did poorly, owing to their unfavourable situation—too close to green trees. Cinquatina cobbed freely and matured early, and is a good poultry grain.

Sorghum.—Four varieties of sorghum were sown, Early Amber Cane and Saccharatum making most rapid growth; but Imphee and Planter's Friend, which from appearance, colour of seed, and rate of growth, seem to be one and the same variety, though of slower growth, produced a greater amount of fodder.

Teosinte, pearl millet, and Kaffir corn resemble the sorghums.

Teosinte excelled in the production of fodder, which horses and cattle eat with avidity. This was sown in the second week of December, and attained a height of 5 feet. It stooled remarkably, and some plants cut on 12th March made a second growth of 18 inches in height. Plants that were not cut in March sent up stems to produce seed, but frosts during the last week of April prevented it from maturing. The stems and leaves of teosinte were much softer than those of maize or sorghum, and it should make good ensilage.

Millets.—Four varieties of millet were grown, White French making the most rapid growth, and being succulent when young, but the stems became very coarse and hard as it advanced towards maturity. It produced a great amount of seed, which is a fine grain for chicks.

Hungarian produces more flag, and seems a better fodder, and Japanese, which approaches the latter closely.

New Siberian is moist and succulent when young, but as it attains full height becomes too coarse and hard to be relished by stock.

Pearl millet grew satisfactorily. It stooled well, and each plant produced a large amount of fodder, succulent when young, but became hard and dry when seed-stems grew up. Not so valuable as teosinte.

Cotton.—Three varieties of cotton were sown, but grasshoppers destroyed young plants. Carolina Prolific made most progress, plants of this variety attaining a height of 2½ feet and flowering freely, but failed to produce pods.

Cowpeas.—Several varieties were sown, and all made rapid growth, and produced root-nodules freely. Mauritius Beans did not produce pods, but all other varieties did so prolifically. Among them were Black, White, Clay, Upright, and Whip-poor-Will.

Field Peas.—Two varieties, Suntop and Partridge, were sown, and both thrive in summer and autumn. Like the cowpeas, they should be beneficial for rotation crops.

Many other kinds of plants were grown here in small quantities, but they were vegetables and plants too well known to need mention.

Grown at Burrimbooka Public School Experimental Farm, Bombala.

GEO. W. ROBINSON, Teacher.

Area of experimental plot, ¼ acre; soil, light chocolate, rather clayey. Climate cold, subject to frosts from beginning of April till midway in October. The season was an adverse one as far as success was concerned, owing to the very limited rainfall from end of October till the end of March. All late sowings were failures. Shortly after the first sowing, early in October, 6 inches of rain fell, followed by a foot of snow. Plants affected by frost failed to germinate. Better results may be looked for next year, as the soil

is trenched to a depth of 2 feet, and will not be so sour. Last year was the first time it had ever been dug. Adjacent green timber is also removed or rung.

Crimson Clover.—Sown late in October, germinated thinly, but throve well.

Alsike and Perennial Clover.—Sown early in October, germinated well; rather affected by dry spell.

Prairie grass.—Sown late in October; affected by dry weather, but recovered very quickly on arrival of rain.

Timothy grass.—Same as Prairie.

Cocksfoot.—Same as Prairie.

Meadow Foxtail.—Same as Prairie.

Meadow Fescue, Poverty Bay Rye.—Sown early in October, throve well; nearly every seed germinated. These two were the best in the garden as regards germination, growth, and stability in dry weather.

Frost has not affected the above list.

Paspalum virgatum, Paspalum dilatatum, Rhodes grass, Natal Red-top grass, Sheep's Fescue, all failed to germinate, possibly owing to heavy rain and 12 inches of snow fourteen days after sowing. I saved a little of each seed, and will experiment again next year.

Canary.—Sown late in October, matured in February, 2 feet high; full heads of seed.

Planter's Friend, Early Amber Cane, Sorghum Saccharatum.—October sowings failed. Sown in November, but dry weather militated; grew 2 feet high; killed by frost before it came into ear. The fall of snow in October was abnormal. With an ordinary season, I think these three can be grown with success.

Rape, Thousand-headed Kale.—Sown in October and March. Both sowings germinated well and flourished; splendid for summer and winter fodder.

Hemp.—Sown October, November, December; failed to germinate.

Skinless Barley.—Sown in October, matured in January: ears large and full. Can be grown to advantage.

Japanese millet, White French millet, New Siberian millet.—Sown October and November, matured in March, 2 to 3 feet high. With an average season these could be grown considerably better.

Flax.—Sown in October, matured in February; germinated well; grew only 2 to 3 feet high; fibre of good quality; seed large and full. If sown in March or April, this plant could be grown here with considerable success.

Potatoes.—Beauty of Hebron—Sown late in October, matured in February; five or six moderately-sized potatoes under every root. Result, considering dry weather, very good.

Aroostook County Prize potato.—Sown late in October, matured in February; average of two small potatoes under each root.

White mustard.—Sown in October; germinated well; ready for cutting in three weeks; exhausted midway in December. March sowing not quite so prolific.

Notes on the Honey Exhibit at the Royal Agricultural Show, Sydney, 1906.

ALBERT GALE.

VIEWED from any point, the honey, wax, bees, and the appliances used in modern bee-culture was a success far beyond expectation. From an educational point, school teachers and scholars could learn much. In that building there were many object lessons ready to be transmitted to the blackboard; not in words, but in objects presented to the physical and not the mental eye. Bee-keeping in the early part of the last century was represented in the old skeps; the straw hives that our great grandfathers used in their day, in regions where the winters are longer and more severe than they are in our mild Australian climate, and, in this year of grace, by the most modern appliances; labour saving, both for the tiny worker and her more intelligent master; appliances invented for a twofold purpose—the life-saving of the bee and profit for the bee-keeper. There were the "little busy bee" and the wonderful and mysterious mother-bee (the queen) open for inspection to the curious school girl and the practical amateur bee-keeper; where bees, on their native combs, could be seen in a state of nature without attempting to molest the observer.

In some observations by that wonderful blind man Francis Hüber, written on the 15th of May, 1790, he says, "M. de Réaumur had not witnessed everything relative to bees when he composed his history of these industrious animals. The German naturalists, Schirach, Hattorf, and Riem sometimes contradicted him." And well they might. The mysteries *within* the beehive were then unobservable, and all they knew and all they wrote were mere conjecture. When in the Honey Pavilion at the late Exhibition, any observant school boy could learn more from what he saw than these deep-thinking naturalists could learn by hard graft in a lifetime. All honor to them. Such scientists and theorists were followed by the invention and discoveries of such practical bee-keepers as Baron Berlepsch, Rev. L. L. Langstroth, and others. All the foregoing men marked out the path that led directly to that splendid display of bees and bee products we saw in last Easter exhibition.

The "catalogue of the Show" set forth fifteen classes for exhibits, not including "specials." For hives and appliances there were only four entries. In the hives exhibited there was nothing remarkable, and the only other appliance exhibited were some splendid samples of comb foundation. Why should *appliances* be confined to hive and comb foundation

only? There are many appliances that are used in the bee industry that are essential to modern bee-keeping. One of the objects of such an exhibition as this under review is that of education. If a large number of appliances other than that of comb foundation were exhibited by these practical exhibitors, and their uses explained at stated hours during the Show, what object lessons they would be for the rising generation! The samples of comb foundation competing were almost faultless, and called forth many an encomium from the sightseers and bee-men.

Beeswax was divided into two classes—natural yellow and natural white, for which there were seven entries. A. Burton took first prize in yellow. The natural yellow was a beautiful straw colour, free from all foreign matter and an even colour throughout—just the colour chemists are always on the search for. The natural white stood the same tests as the yellow, and was closely identified with it, except in colour. W. Abram took the first prize. Pure white wax is extremely useful for altar candles. The production of wax, if carried on more extensively, would make it important in the profits of bee-keeping. In the market wax is bringing a high price just now.

There were five classes devoted to honey. Water-white, golden, and dark were the classes for liquid honey. In awarding the prize to each class the judges had their work before them. Each exhibit had to be handled five times. Honey, and, indeed, all exhibits in the apicultural section, is judged by points, thus:—Flavour, 40 points; aroma, 10; clearness (freedom from foreign matter), 20; colour, 10; and density, 20. These are the spectacles with which the practical man sees his honey. The spectacles with which the consumer views his purchases are binocular —colour and flavour, *i.e.*, if he can see flavour. Indeed, too often he is content with the colour alone. Some of the darkest honeys are of excellent flavour. Taste is frequently acquired, and always more or less arbitrary. The first prize for water-white went to W. Abram, and justly; and the first prize for golden went to Thos. Murphy—a bright, clear, attractive honey; a honey that should suit the English market, if a regular supply of it could be kept up. Dark honey. What is dark? In the two former classes there were comparatives mentioned wherewith to contrast the exhibits; but in class 817 there was no guide to lead the judges up or down to what is *dark*. Fortunately, there were only four competitors; but this meant forty-eight bottles of honey to be more or less examined. If honey were used only for table purposes, then the National Bee-keepers' Association would do well to exclude it from the catalogue; but it is used in manufactures, therefore it has a right to the place it occupies. I have seen some vile tasting and smelling honey of this class on the table at shows, and some such honey as this has more than once been exported to the Old Land. No wonder Australian honey has been cried down, when the Home consumers have seen, tasted, and handled Australian dark honey!

There were two classes for granulated honey,—fine and coarse grain. There were five entries in each class. How is it that the honey-consuming

public object to granulated honey? For children, it will go further than liquid honey; it is not so easily to be adulterated as the former, and if the bottles are left open it is not so likely to lose its aroma. Fine grain has more votaries than the coarse. The prize fine grain was an appetising sample, *i.e.*, for those who prefer it to the coarse grain; to the taste, full of flavour; to the eye, white, free from specks and unclouded; to the touch, soft and of a buttery consistency. The first prize went to T. Murphy, and the first for coarse grain to H. R. Roberts.

Comb honey—1 lb. sections. These, also, were divided into two classes —one light and the other dark. The sections of light honey were superb. The cappings, for evenness, could not be excelled; in some cases, they were almost as even as if finished-off with a trying plane. For evenness, there was scarcely a fault in any exhibit. In colour, too, these sections advanced a long way towards perfection, and were it not that some of them were incomplete, the judges would have had all their work cut out, if the points by which they were to be adjudged were confined to surface evenness and colour; but, fortunately for the judges, completeness and neatness are of equal merit with that of evenness and colour. Too many of the sections were incomplete. Each exhibitor had to table one dozen sections. To obtain complete sections, *i.e.*, such as have every cell filled with honey and capped, as well as the section-frame perfectly filled from side to side. Exhibitors too often have interstices in the corners of their sections large enough for a mouse to crawl through; others, again, will cut down frame-combs and fit them in the sections, and trust to the bees to work them up for exhibition purposes. If the judges are alert, such manipulations do not always work out to the satisfaction of the exhibitor.

For exhibition purposes, large frames of honey, that is, frames having not less than 100 square inches of superficial measurement, are far superior and satisfactory for judging than sections, in so much as, to my mind, it gives an exhibition of a bee-master's skill in their production far more so than is the case with sections. Comb honey is always a very great attraction to the visitors at shows. Such honey is free from *all* impurities, and is relished by the consumer as a specialty amongst honeys. The Psalmist had the same liking for comb honey when he said, "Sweeter than honey or (in?) the honey-comb." For large frame of comb, 100 square inches, H. R. Roberts took first prize; and for the smaller size, 50 square inches, W. S. Seabrook took first and second prizes.

Classes 824 and 825 were reserved for queen bees and their progeny. The National Bee-keepers' Association makes a strong distinction between a queen bee and her progeny and bees in hives. In the latter, all details are taken into consideration, such as colour of queen and her progeny; strength of stock, and even their temper; the quantity of brood and the regularity of its distribution; the uniformity and perfection of brood combs, and even the utility of the hive. These qualities are only used when the bees are adjudged in the open air. When exhibited under cover, the queen and her progeny only are taken under consideration.

Class 824 was a prize of £2 (second prize, £1) for the best leather-coloured queen, including her descendants; and Class 825 differed only in the colour of the insects, these were to be golden in colour. For the leather colour, the first prize went to A. Burton, and the second to W. Abram. With the golden, the order of merit was reversed, W. Abram taking the first prize and A. Burton the second.

Nothing in the whole realm of apicultural judging is more difficult to compare for prize purposes than the queen bee. (All judging is by comparison.) First you have to find the queen. No easy matter, when you remember you have to discover her amongst some hundreds of workers, every one of which is marked and tinted alike (or should be). From amongst all these the queen is to be detected. Add to this the shyness of the queen; under the most favourable circumstances they are shy of observation, and after they have been carted for miles, and more or less tumbled about, they are doubly so. Under such circumstances, is it any wonder that she is so fond of having a game of hide-and-seek with her observers? When she is found, the judge must note her purity of strain, her colour, her form, and her size. As soon as the judge has seen her, and noted her points, he has to hie away to the next competing queen, and the same catalogue of observations are to be gone through, and so on from queen to queen until he has observed and noted all the queens on the show table. Having selected those considered to be on the top notch, then comes the trouble of comparisons. The lot of the judges of bees is not a happy one, nor one free from trouble.

Exhibitors could save a host of trouble to the judges, and disappointment to themselves, if the exhibition frame was made to fit the small glass show-case so that there should not be *bee space* between the sides of show-case and the bars of the frame. Queens have a knack of dodging behind the bar-frames, and thus prevent proper observation. If the queen and her progeny were on one side of the frame it would save a lot of trouble. I have known a queen to hide behind a bar-frame so completely that her owner had to take her home without her having been seen by the judges.

The blue ribbon of the apicultural display centred in the special prize —"Collection and display of the products of an apiary in trophy form." First prize (champion), £7; second prize, £3; third prize, £1 10s. These prizes fell, respectively, to H. R. Roberts, W. Abram, and W. S. Seabrook. There were two non-competitive exhibits in trophy form, that of Mr. Trehair and Mr. Smith; the display of the former was greatly commended. In a future article, I shall deal with displays of the foregoing nature, accompanied with illustrations.

In the honey and bee pavilion, there was a non-competitive exhibit that demands more than passing notice—the appliancs (the tools) exhibited used in bee-culture. In variety these far exceeded in number the proverbial "101," from the cotter's straw hive of 100 years ago, when the most valuable of all domestic insects had to give up their precious

stores by the aid of "fire and brimstone," and the whole "bee nation" destroyed to tickle the palate of man, down to the most modern tools for obtaining the greatest quantity of the "sweets of life" without the suffering and destruction of the tiny workers. Here were object lessons by the dozen in bee life and the economy of the hive; but there was something wanting—no one was set apart to give lecturettes to the many thousands of people who daily visited and constantly asked questions about that branch of the valuable Easter Show—the bee and honey pavilion.

Value of Maize Cobs.

[Page 475, May *Gazette.*]

In answer to several correspondents, Mr. R. H. Gennys supplies the following note on the above subject:—

The material used in the pig-feeding experiment consisted of half by weight of maize cobs with the immatured grain on, and the other half was bare cores, from which all the grain had been stripped and sold at a good price. The pulling, husking, bagging, carting, and shelling of the latter (the cores) it is contended are fairly chargeable against the grain taken therefrom. The labour of grinding amounted to as nearly as possible to one guinea for the meal required. The amount mentioned for harvesting cobs includes also all the other expenses, such as feeding the pigs and mixing the material, the latter consisting of merely pouring on water and roughly stirring. The amount chargeable to the feeding and mixing is £1 4s. 5d., and I would like to state that this would be insufficient unless the feed-shed is handy to the yards, and the yards not too far away from the feeder's residence. I think these items, on the average, might be placed at 10s. more.

The pigs, during the time they were being fattened, were kept in a large yard, the cost of feeding, cleaning, &c., being reduced to a minimum.

Reports from the Commercial Agents.

UNDER date Kobe, 31 March, 1906, the Honorable Premier and Colonial Treasurer has received a report from Mr. Suttor with reference to the trade of Japan, and also some statistics in connection with the total trade for the year 1905, reserving for a later date a more detailed report.

During the last three months, many matters of commercial interest have been engaging the attention of the Imperial Diet; the session being brought to a close on the 28th instant.

Among the more important measures passed are included a Bill to nationalise the Railways of Japan, and, at an estimated expenditure of £50,000,000, by means of bonds; the flotation of a domestic loan of £20,000,000; and alterations in connection with the customs tariff.

There has been much heated opposition in connection with the railway nationalisation, the time being considered inopportune for the issue of more bonds on an already congested market. However, the bill has passed both Houses in a slightly modified form, the conversion to take place, I believe, extending over a period of ten years. Of the total railways in Japan, amounting to about 4,000 miles, only about 400 miles belong to the Government, so that it will be seen the scheme is rather a large one, and, taken in connection with the domestic loan of £20,000,000, will mean the absorption of a lot of money considered more useful for commercial enterprises, and considerably curtail the amount of money available for speculative purposes in connection with bank advances.

Unless inducements are offered for the inflow of foreign capital, it is feared that the local rate for advances will considerably increase, and retard the industrial progress of the country.

Viewed from various points, Japan is certainly about to pass through a most interesting period.

In connection with trade matters, imports still show a considerable excess over exports, as will appear by the following :—

1905—Imports	£48,852,327	0	0
1905—Exports	£32,153,373	4	0
1905—Excess of imports ...	£16,698,953	16	0

In 1904, the excess of imports over exports equalled the sum of £5,209,984 4s.

The following statistics will give an idea of the total values in connection with exports and imports for the years 1904 and 1905 :—

EXPORTS.	1905. £	s.	d.	1904. £	s.	d.
Manufactured Articles—						
Silk tissues, Habutae	2,805,798	0	0	3,754,609	18	0
,, Kaiki	61,452	10	0	44,906	0	0
Silk handkerchiefs	489,261	2	0	469,959	6	0
Cotton tissues	1,149,208	2	0	774,343	2	0
Towels	161,808	12	0	137,420	4	0
Matches	1,036,076	8	0	976,386	0	0
Mats and matting	508,698	16	0	491,735	16	0
Porcelain and earthenware	532,432	8	0	387,302	2	0

EXPORTS—*continued.*	1905. £	s.	d.	1904. £	s.	d.
Manufactured Articles—continued.						
Lacquered ware	123,002	0	0	102,329	6	0
Umbrellas, European	158,279	18	0	138,247	10	0
Cigarettes...	309,213	6	0	251,284	16	0
Others, not enumerated	3,133,029	2	0	2,249,536	12	0
Manufactured Articles—Half-wrought—						
Raw silk	7,184,375	10	0	8,874,070	4	0
Silk, noshi and waste	623,316	12	0	559,072	18	0
Cotton yarns	3,324,646	4	0	2,926,845	12	0
Straw plaits	382,710	16	0	516,561	4	0
Tea...	1,058,432	8	0	1,283,883	6	0
Camphor	256,623	6	0	316,819	14	0
Others, not enumerated..	3,440,664	6	0	2,388,927	6	0
Raw Products—						
Coal	1,426,786	12	0	1,482,809	6	0
Rice	312,698	18	0	472,486	0	0
Cuttle-fish...	214,782	16	0	266,612	2	0
Seaweed and cut seaweed	154,939	14	0	124,651	10	0
Mushrooms (dried)	103,695	2	0	130,322	10	0
Copper (coarse and refined)	1,604,845	4	0	1,290,777	10	0
Fish oil	74,085	16	0	76,635	10	0
Vegetable wax	80,429	18	0	110,299	12	0
Others, not enumerated	1,441,679	18	0	1,327,754	10	0
Total Exports	32,153,373	4	0	31,926,089	12	0

IMPORTS.	1905. £	s	d.	1904. £	s.	d.
Group No. 1—						
Raw cotton	11,062,318	6	0	7,342,038	12	0
Cotton yarns	170,186	0	0	34,329	0	0
Wool	834,757	6	0	997,105	10	0
Flax, hemp, jute, &c.	335,825	2	0	226,225	16	0
Iron nails	260,873	18	0	196,005	10	0
Rails	94,263	4	0	169,691	16	0
Iron (bar and rod)	719,776	10	0	430,150	12	0
Iron pipes and tubes	213,689	18	0	131,175	14	0
Other iron and steel	1,877,169	18	0	920,527	12	0
Indigo (dry)	282,273	18	0	211,767	16	0
Paper	633,740	10	0	302,533	6	0
Leather (sole and other)	1,405,241	4	0	436,496	14	0
Machinery and engines	2,092,325	8	0	988,275	0	0
Railway engines and cars . ..	437,690	14	0	320,541	18	0
Steam vessels	766,029	8	0	931,969	6	0
Others, not enumerated...	6,413,720	8	0	4,028,136	8	0
Group No. 2—						
Mousseline-de-laine	306,636	16	0	181,855	2	0
Woollen cloths	1,087,930	18	0	175,425	10	0
Shirtings and cotton prints	963,164	12	0	355,393	6	0
Cotton satins and velvets	286,401	6	0	95,012	6	0
Sugar (brown and white)	1,370,618	14	0	2,304,300	16	0
Others, not enumerated...	4,136,282	12	0	2,854,345	14	0
Group No. 3—						
Rice	4,796,431	14	0	5,979,191	2	0
Beans, peas, and pulse	1,059,531	4	0	862,484	12	0
Flour, wheat	995,136	16	0	962,539	16	0
Kerosene oil	1,206,126	4	0	1,820,149	0	0
Oil cake	1,136,046	10	0	466,855	0	0
Others, not enumerated...	3,907,437	10	0	3,411,551	2	0
Total Imports	48,852,327	0	0	37,136,073	16	0
Total Exports	32,153,375	4	0	31,926,089	12	0
Total trade for 1905–4 ...	£81,005,700	4	0	£69,062,163	8	0

It will be seen from the above, that the exports show an increase of £227,283 12s. for 1905 compared with 1904, whereas the imports show an increase of £11,716,253 4s. for the same period.

In exports, the most notable increases are to be found in connection with silk kaiki, handkerchiefs, cotton tissues, towels, matches, mats and matting, porcelain and earthenware, lacquered ware, umbrellas, cigarettes, &c.—in fact, all articles under the heading of manufactured articles, with the exception of habutae, show considerable expansion, and thus illustrate a growing demand for local productions, which the Government are encouraging all in their power.

In half-wrought articles increases are to be found in silk noshi and waste, cotton yarns, and articles not enumerated. The decreases are in connection with raw silk, straw plaits, tea, and camphor, and which I attribute to the unfavourable seasons in the north; any falling off in these articles has a serious bearing on the poorer classes, and has added much to the distress already being experienced in certain parts of Japan, and where the people live a sort of hand-to-mouth existence.

Under the heading of "Raw Products" it will be noted that increases are only to be found under the headings of seaweed, copper, and others not enumerated. The recent active demands for China had a lot to do with the increased output of copper, more especially for copper of over 99 per cent. purity; but now that China is about adopting a silver currency, and as per remarks in a former despatch, it is hard to forecast as to whether the demands for Japanese copper will show a similar increase for 1906 compared with 1905.

In decreases it will be noted that coal exports are accountable for £56,022 14s., and which I put down to inability to increase the output at the southern collieries: many incline to the belief that scarcity of labour is the chief cause, but having in view the great activity being displayed in opening coal-mines in the extreme north, combined with a knowledge that labour is plentiful, forces me to the opinion that the southern mines have about reached their maximum output, otherwise the northern mines could not compete with the southern ones. The local selling rate for all coal has also considerably increased, the average prices at Moji being as follows:—

	£	s.	d.	
First quality coal	1	1	10	per ton.
Second "	1	0	0	"
Third "	0	17	8	"

There is also evidence that the present prices are not likely to be reduced, especially so long as the increased taxes to meet expenses in connection with the late war are in force. The cost of living has certainly considerably increased of late, and consequently all grades of labour are demanding increased wages.

Now that local consumers are forced to pay a higher rate for an inferior coal, attention is naturally diverted to other markets, and many inquiries have been made at my office in connection with importations of New South Wales coal, and certain trial shipments ordered.

The falling off in rice is attributable to the unfavourable season at the time of harvest, and increased demands for local consumption. The same also practically applies to shrinkages in exports of fish, mushrooms, fish-oil, and vegetable wax, and owing to unfavourable elements at a seasonable time.

Imports.—In connection with the statistics quoted, there are many items of considerable interest, all tending to illustrate how much Japan is dependent on other countries for raw materials; and even in connection with manufactured importations, there is strong local evidence that future importations will harmonise more with a growing desire to manufacture locally by the importation of the necessary raw materials. As an illustration of my views, just take the case of wool. It will be noted that the importations of the raw material show a falling off of £162,348 4s. compared with 1904, but taken in connection with woollen cloths there is an increase of £750,157 4s., and which I attribute to nothing else but a growing demand for woollen goods. The output of the woollen mills being fully taxed, attention was naturally forced to the importations of the manufactured articles, while attention is being locally given to increased local manufactures, with marked attention to Australia for the raw material.

Since I arrived in the East I have done my utmost to bring our wool prominently before all interested people, and have induced leading people to visit Sydney, and feel good results will follow. Only last week I received a request from a large wool-buyer, who had not hitherto been on the Australian market, to place him in touch with a reliable wool-broker in Sydney. I have done so, and have reason to believe that orders have been sent to Sydney—the request being for cross-bred, medium cross-bred, and fine merino wools. I am very hopeful that satisfactory results will ensue and be the means of permanently diverting the attention of a large wool-buyer to Australia.

During the last winter it has been a frequent occurrence to see native children and adults dressed in European clothing, principally woollen goods, which is strong evidence of a change in ideas, and appreciation of woollen garments. The same is also observable in many of the shops, where woollen garments are becoming conspicuous for sale.

Raw cotton also shows a considerable increase and £3,720,279 14s. more than for the year 1904. Much of this cotton is mixed with wool and worked up accordingly into suitable garments, a large percentage of cotton being made into yarns and exported, advantage being thus taken of the cheap labour in Japan for this purpose, and which is gradually assuming large proportions.

I beg to invite special attention to the importations of all grades of leather. It will be noted that importations reached the high figure of £1,405,241 4s., and thus give an increase of £968,744 10s. compared with 1904 importations. The local requirements are far in excess of local productions. Certain New South Wales leathers are reaching the market, but we are not doing the business we should do. At the latter end of last year I had the honor of writing you with reference to certain requests for leathers, as per samples forwarded, and asked for early information. The request was originally made by the largest leather consumer in Japan, but up to the time of writing I have not received any reply to my humble request, and have been frequently asked when a reply may be expected. It is always advisable to send early

replies to Japan, if only to announce the article cannot be supplied; not being able to get a reply is apt to be misunderstood, and often leads to hostile remarks. For the class of leathers referred to the demand is very active in Japan. I still hope the matter may not be lost sight of and that business will yet eventuate.

In machinery, it will be noted that the importations show an increase of £1,104,050 8s. compared with 1904. The importations are principally in connection with large engineering works, ship-building yards, &c., strong evidence of the activity being displayed from an industrial point of view.

Oil-cake is also another conspicuous item as showing a considerable increase. The demand is still active with every prospect of continuance.

I am glad to note that flour shows an increase of £32,597 compared with 1904. I am given to understand that wheat also shows a considerable increase, but detailed statistics are not yet available, and may not be ready for another six weeks. There cannot be any question about the increase in the consumption of flour in Japan. The last three months also affords extra evidence—in fact, the local market is just now glutted with American importations, and which will take some weeks to work off. Doubtless, this state of affairs has been added to by the Chinese boycott and desire by American millers to ship to the East in anticipation.

New South Wales flour is establishing quite a reputation in the East, and spoken highly of—in fact, it is looked upon as too good, if anything, and consequently quoted at a corresponding price, whereas the American medium-quality flour is always quoted at a lower figure, and commands sales accordingly.

The Americans are certainly making a special bid for a strong footing on the markets of Japan. Already I hear of a bill being passed to subsidise certain steamers on the Eastern run and with a view to uniform freights. Commercial Agents are also active in exploiting new markets and reporting to Washington on future prospects, &c. England, Germany, and Canada also have commercial representatives in the East, so that future competition is sure to be very keen; still, I do not fear that New South Wales will suffer much, more especially with uniform freights and certain shipping.

Since my return from Manila, I have received many requests for New South Wales products, and have endeavoured to place inquirers in touch with Sydney interests. I have also received active inquiries for bones, sinews, &c.—in fact, I cabled you for a firm (not hitherto in the Australian trade), but have not yet received a reply. If business can be arranged, as per my cable, then I feel the firm in question will, later on, take all we can supply, and probably run an occasional steamer to Sydney.

The exhibits for the Commercial Museum at Osaka have been received and are being placed in position. The room formerly allotted has proved insufficient, so that a larger room, on the ground floor, is being placed at our disposal. The exhibits are much admired, being visited by a large number of interested people, which is certain to do a vast amount of good. I only regret I have not similar exhibits for the museum at Tokio.

The Cultivation of Paddy-rice in Japan.

Mr. Suttor, the Government agent for this State in Japan, was requested some while ago to, if possible, obtain some information on Rice Cultivation.

Mr. Suttor has now forwarded a statement supplied to him by the Department of Agriculture, Tokio, as follows:—

The cultivation of Paddy-rice, mainly with regard to that of Tokio District, is described in the following:—

1. *Seed-bed.*

A portion of "paddy land" is prepared as the seed-bed, where it is pretty warmly sheltered from severe wind and convenient for irrigation. The position generally chosen for the seed-bed is close to the farmer's dwelling, so that frequent visits can be made to it in connection with irrigation, water discharge, or prevention of injurious insects, &c. In April the soil is made into fine tilth, but not too deep, and manures are well mixed with it. The surface of the soil thus prepared is evened so that the irrigated water can be drawn in and out easily. The soil is then left a day or two to settle down, and the sowing takes place generally at the beginning of May. After the seed has germinated the irrigation water is often drawn off during the day-time, and the tender seedlings exposed to the sunshine to make them grow stout and healthy, but in stormy weather the water is much increased, and deepened to protect the seedling from heavy rain or storm. After forty to fifty days from sowing, *i.e.*, from the middle to the end of June, when the plantlets have grown 8 to 10 inches, they are ready for transplanting on the "paddy land."

The quantity of seed to be sown in the seed-bed for every acre of paddy land is 1 bushel—the total area of the seed-bed being about 150 square yards.

The quantities of manures given to a seed-bed of 150 square yards are:—46 gallons of night-soil, with or without superphosphate of lime or ashes, say 10 to 15 lb.

2. *Preparation of Soil, Manures, and Weeding.*

In May or June the paddy land is turned over by ploughing and irrigated, and the undermentioned manures are given per acre:—

1. Night-soil, 10 to 12 barrels, with or without some superphosphate and ashes.
2. Fish manures, 400 to 450 lb., with some ashes.
3. Soy bean-cake, 600 to 700 lb., with superphosphate of lime and ashes.

The transplanting takes place from the middle to the end of June; and two weeks after planting the water is discharged, and the weeds are taken up. This process is repeated two or three times.

3. *Length of time in maturing.*

The length of time in maturing varies very much with the variety of the rice plants, but it fluctuates between 150 and 200 days.

4. *System of Harvesting.*

The crop, when matured, is harvested with a simple sickle and made into small bundles which must be dried well by being exposed to the sunshine, either spread out on the land or hung up in some bamboo frames. Thrashing is performed by some long iron teeth (fixed in wooden frames) which separate the straw. The grains thus separated are spread on mats and thoroughly dried by exposure to the sun; then the chaff is stripped off by rubbing the grains through a wooden machine. The grain is then sent on to be dressed. The good yields of the crop for an acre may be estimated as between 40 and 50 bushels.

Upland Rice.

Upland rice is sown generally between the rows of winter barley in May, at the rate of from 6 to 7 gallons per acre, so that there is no necessity to prepare the land specially for the crop.

Cultivation and manures per acre :—

Compost, 5,000 to 6,000 lb.
Soy bean-cake, 150 to 200 lb.
Superphosphate of lime, 150 to 200 lb.
Night-soil for top dressing, 3 to 5 barrels.

Compost, Soy bean-cake, superphosphate of lime, &c., are mixed up well and applied to the field, *i.e.*, between the barley rows, before the sowing, and slightly covered with earth. In June, or the beginning of July, when the barley is harvested, and when the rice plantlets will be 5 to 8 inches high, a quantity of night-soil is given near the roots of the plantlets, and the soil is pulverised and earthed up neatly, so that the barley stubbles can scarcely be seen. At the end of July the remaining night-soil is given and earthed up in the same way as before.

Harvesting.—In October, when the ears are full and drop down, and only the upper part of the straw remains yellow, it is harvested in a similar way to that of the ordinary rice crop previously described. Generally it is safer to cultivate much earlier varieties of the upland rice as compared with the ordinary rice in the same district, because it is more liable to suffer damages from the stormy weather so common in Japan during September and October.

The yield per acre is much less than that of the ordinary rice; 30 bushels will be regarded as a good yield.

Damages.—The mountain rice is a precarious crop, being particularly affected by dry weather in summer, especially near its earing period.

Orchard Notes.

W. J. ALLEN.

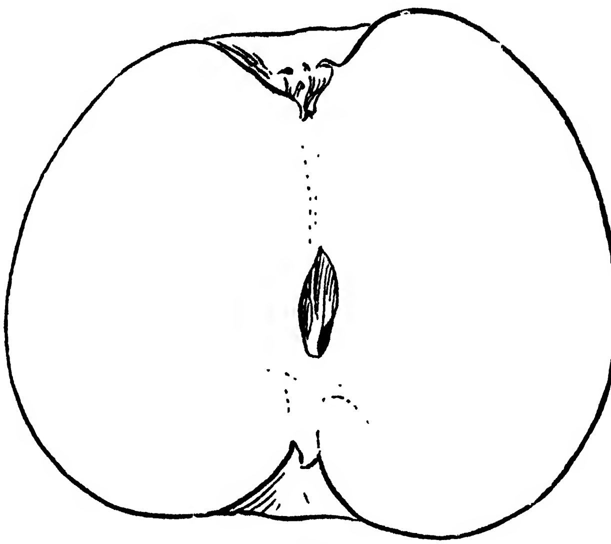
July.

The most important work during this month will be the pruning of all deciduous trees. This work should not be neglected, and it is just as essential for the man with a small orchard to do the work as it is for the large orchardist. The amount of wood to be removed will depend entirely

Wagener Apple—Bathurst Orchard.

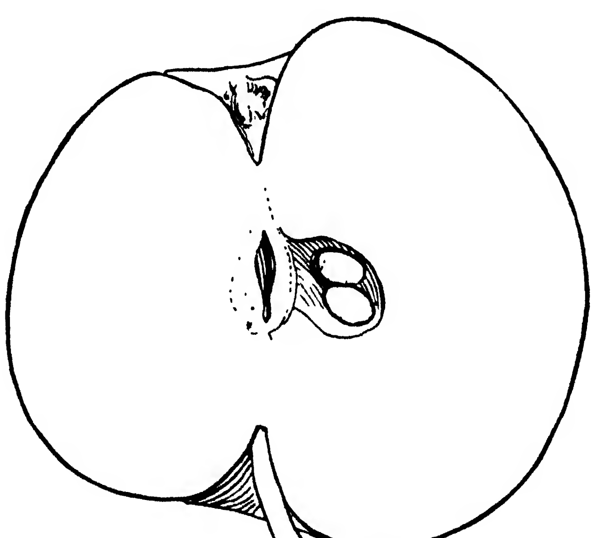
on the condition of the tree and the kind of fruit-tree to be pruned. Generally speaking, the peach and nectarine are about the hardest to prune, and usually require the most severe treatment. Many varieties of Japanese plums put on heavy growth and, in consequence, require to have considerable wood removed. Apple and pear trees require to be kept within bounds, but it will not be found necessary to remove so much wood from these trees when once they have begun to carry heavy crops of fruit. With some of the very upright varieties of apples, such as the Shepherd's

Perfection, it might be found advantageous to allow these to go unpruned for a year in order to spread them. Then there are varieties, such as the



Gano.

Cleopatra, which, if not pruned so as to keep the tree well opened out in order to admit light and air to its centre and along the branches, will be



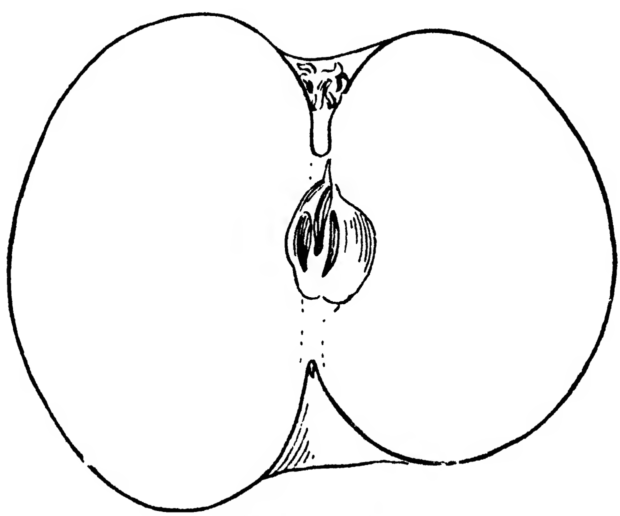
Wagener.

found, in many places, to develop bitter-pit so badly as to make them practically valueless.

If too much wood be left on the trees the crop will, in all probability, make such a drain on the tree that not only will the fruit be small and badly flavoured but the tree will be so weakened as to unfit it for producing a crop the following year.

Let each fruit-grower, therefore, study the habits of the different trees and prune them in such wise as will cause them to return him the best fruit from year to year; and, under no circumstances, allow any tree to be started with long trunks and the limbs bare of fruiting wood, which only exposes them to the sun's rays and, in all probability, will result in their being burnt and stunted and so weakened as to be of little commercial value.

During the last few weeks it has been my experience to visit an orchard which had been practically ruined by an incompetent pruner, and the owner



Tewkesbury Blush.

thought it more economical to uproot a large percentage of the trees and plant anew rather than try to bring the older trees back into a profitable condition.

In connection with the pruning of grape-vines, the Sultana requires long spurs, as the bud or two next to the old wood seldom produces any fruit-bearing canes; while, on the other hand, the Gordo Blanco is best pruned back to short spurs, as all buds on same are found productive, and if too many are left it is usually found that those buds furthest away from the old wood only develop properly and produce fruit and strong canes, while those next to the old wood remain dormant, and it is then found hard to prune correctly the following year, as the best wood in place of being close to the old wood on the crown of the vine is some few inches further away than is desirable. The latter vine should always be pruned so as to form a compact and not a spreading head.

In packing and handling citrus fruits, see that they are not bruised, else they will not keep. The fruit should be well graded and neatly packed so that it may present a good appearance when offered for sale, as badly graded and packed fruit does not sell so well as that which has been properly prepared.

All refills should be planted without further delay. When new orchards are to be planted the sooner they are in now the better, as the roots start growing this month and the better hold they get of the ground in the early part of the season the stronger growth they will make during the summer.

While pruning or working around the trees always keep a sharp lookout for any diseases which are liable to attack them, and should any be found, mark the trees affected so that at the right time they may be given a proper dressing.

COLOURED PLATE.

The following apples are among those which were imported from America last fall and early summer. They usually arrived here in good condition and found ready sale at fair prices. We have Gano and Wagener growing at the Government orchards, and hope to add Tewkesbury Blush to our collection at some future time :—

Gano.—Originated in America, either in Tennessee or Missouri, and said to be a seedling of Ben Davis. Fruit medium large, oblate, irregular. Skin yellow, partly covered with dark red and with occasional stripes and patches of russet. Flesh yellowish-white, subacid, of good quality. Ripening rather late, and suitable for export.

Wagener.—Originated in the State of New York. Fruit medium large, shaded and indistinctly striped with pale red and a full deep red in the sun on warm yellow ground, sometimes streaked with russet; stalk three-quarters of an inch long, cavity wide, rather obtuse; basin even, rather large. Flesh yellowish, fine grained, tender, mild, subacid, aromatic; ripening late in fall at our Bathurst orchard.

Tewkesbury Blush.—Originated in New Jersey. Fruit round, oblate, rather small, yellow with a red cheek, juicy. Flesh yellow, subacid; very good dessert. Ripening late, and said to keep well in America.

MONTHLY WEATHER REPORT.

HAWKESBURY AGRICULTURAL COLLEGE.

SUMMARY for May, 1906.

Air Pressure (Barometer.)			Shade Temperature.				Air Moisture Saturation=100.			Evaporation (from Water Surface).			
Lowest.	Highest.	Mean.	Lowest.	Highest.	Mean.	Mean for 14 years	Lowest.	Highest.	Mean.	Most in a Day.	Total for Month	Monthly Mean for 8 years	% of year's Evaporation.
29·87 28th.	30·56 22nd.	30·214	34·0 31st.	83·1 6th.	57·916	56·621	59 4th.	100 21st, 24th, & 2 th	80·645	·134 13th.	2·508	2·252	5·4

Rainfall (as recorded)	3	13	15	22	23	24	25	28	29	Total,	Mean Rainfall for 14 years.
Dates	3	13	15	22	23	24	25	28	29	Total,	Mean Rainfall for 14 years.
Points	1	8	5	4	20	22½	99	3	2	164½	214 points.

	N	NE	E	SE	S	SW	W	NW
Wind	2				4	1		5

Greatest daily range of temperature, 40·3°, on 17th.

Days on which shade temperature fell below 42°	1	2	5	10	11	16	17	18	30	31
	35·7	38·5	40	41	38·1	35·8	36·1	39·4	37·1	34

W. MERVYN CARNE,
Observer.

Farm Notes.

Hawkesbury District—July.

H. W. POTTS.

So far the weather has been favourable towards cultivation and agricultural operations. The few light showers we have had assisted largely towards this end as well as gives a stimulus to the growth of the winter crop. The early-sown barley, oats, and wheat are looking much better than was forecasted last month.

The last of the maize cobs may be collected this month. The earlier collected corn will be dry enough now to find ample work during the prevalence of cold weather in husking and shelling. Where husking is conducted in the paddock it is important that the cob be thoroughly mature, more especially where the variety of cob is large and thick.

In the face of a dry winter, and possibly a shortage of feed in spring, the American system of conserving fodder by means of the shredder and husker should be adopted. It is only a question of time when the preparation of stores every winter will be recognised as an essential phase in maize growing. Where the stalk is well dried and cured, none of the objectionable features associated with stover, such as the formation of moulds, are present. The climate is very suitable for conserving stover

In out-door operations this month we have to get the land ready for the early maize planting as soon as all prospects of frost are passed. Where the soil is of low grade it involves the application of manures, or the adoption of a suitable rotation, in addition to thorough and deep cultivation. The aim is not only to release plant food in the soil as well as replenish it, but what is of equal importance is to work the soil in order to make it moisture-retentive. Subsoiling to a depth of 8 to 12 inches effects this in most soils. Where it is already loose, light, and sandy, humus should be accumulated by means of green crops turned in or stubbles. The quantity of humus and a loosened deep subsoil to act as a reservoir for moisture provide conditions eminently favourable for maize crops.

Land may also be prepared for cowpeas. In this connection it may be pointed out that this crop should be utilised as a soil renovator.

The land may also be cultivated for early summer crops such as millet, sorghum, pumpkins, and marrows.

It is not too late to put in another sowing of Skinless barley for green fodder in the early summer, and the same may apply to Algerian oats, also Emerald rye.

During the past month the rape crop has been fed off with sheep and pigs. Where there is sufficient moisture a second growth may be fed off.

Turnips afford good feed for sheep at present. The land both after turnips and rape should be cultivated for the early maize crop.

Land may be got ready for the early potato crop in August.

Bathurst District—July.

R. W. PEACOCK.

It would be preferable if the cereal crops, such as wheats, barleys, oats, and ryes, were above ground during this month. Such is not always practicable, and oats and ryes may still be sown if not already in. During the last ten years dry summers have been invariably the rule, and the above cereals to do their best had to rely upon their winter growth rather than upon adequate summer rains.

The early sown wheat crops should be sufficiently advanced to allow of being stocked by sheep if desired. They should be fed off rationally, the stock being kept off when the land is too wet and not kept on later than the middle of August.

The teams should be used in preparing the land for summer crops and the ploughing should be not less than 6 inches deep. All the land to be fallowed should be broken up. The advantages of a bare fallow every few years is not sufficiently appreciated by farmers. Farm-yard manure of all descriptions should be carted on to adjacent fields. Stock and sheep yards could be cleaned up to advantage.

This is the season of the year when fences could be advantageously attended to, and also farm buildings, &c.

In the vegetable garden, peas and broad beans may be sown ; onions, cabbage, and lettuce can be transplanted ; asparagus and rhubarb beds should receive their winter dressings of farm-yard manure, and so also should the bulk of the garden.

There are many things which will occur to the farmer which should be done at this season in order to make the work lighter when the rush of spring planting or harvesting is in progress.

Glen Innes District—July.

R. H. GENNYS.

Wheat may be sown this month for hay purposes, but is getting late for grain. However, with a fair season, there is still a chance of a crop.

Oats.—This is a good month for sowing oats, either for grain or for hay. Good hay sorts and early varieties are Red Rust-proof and Algerian ; the latter is rapidly coming into favour as a grain sort, and is a great yielder.

Barley.—This crop may be sown either for grain or for green fodder. For malting purposes choose fairly rich land, which should be worked very finely for this cereal.

Rye may be sown for grain or for green stuff, and may be grown on fairly poor land with advantage.

Peas, cabbages, cauliflowers, lettuces may be planted.

Plough land for the first time that is intended for Spring crops, leaving it as open to the air as possible.

Ploughing.

Ploughing in Australia is a term often applied to any operation with a plough that blackens, reddens, or whitens the surface of the land run over, according to the colour of the ground to be treated, be the depth ever so shallow. Tickling the soil, this scratching is sometimes called; in very rich soil, with a favourable season, a fair crop is sometimes gathered. but in a dry season the difference between well deeply-worked land and shallow ploughing is very marked. Of course there are exceptions when the latter mode is of benefit; for instance, in destroying the roots of couch, swamp grass, &c., in dry, hot weather, also for causing seeds of weeds to germinate in order that they may be destroyed by after cultivation before the farm crop is put in. Another case, when the top-soil is very shallow and the subsoil very hungry, it is not always advisable to bring the latter to the surface, in this case, however, stirring with a subsoil plough where practicable will be of great benefit. This implement may be described as a strong, sharp, narrow-pointed foot attached to a beam of great strength, without wheel or mould-boards, with ordinary plough handles; this plough can only follow a single-furrow, working right in the bottom of the furrow made by the latter, ripping and tearing the subsoil up but not turning it over. The next furrow-slice of the turnover plough covers up this loose soil, so that it is in the same position as before, but wonderfully improved for the reception of the roots of plants and in its power for absorption of air and moisture. If a little bottom soil does find its way to the top, it is soon sweetened and improved by exposure to the atmosphere. The orchard at the Glen Innes Experimental Farm was first ploughed ten inches deep, and afterwards stirred with the subsoiler to a further depth of five inches—fifteen inches in all from the surface. So far the young trees have made as fine a growth as could be wished, but plenty of shallow cultivation has been indulged in since they were planted, chiefly in the spring and summer months, as in the cold, winter months, whilst trees are in their dormant state, cultivation is not required to any extent. I do not however advocate subsoiling for wheat-growing generally, as this plant is rather partial to a firm subsoil. Five to seven inches as a rule will suffice, and in no case should exactly the same depth be adhered to year after year, or else a road or hard-pan will be formed, impervious to water and also to the roots of the crop. With respect to the best plough to use, both disc and turnover ploughs are good in their places; but the turnover will be found the best to bury rubbish thoroughly and, in new land, to get rid of the grass often abundant; the long mould-board I have found best suited

in this connection; a heavy-linked chain, attached to the plough, is very useful in bending down the grass for the better covering up of the latter. Short mould-boards, however, in many cases are preferred, as they break up and pulverise the soil better. The disc is a capital instrument, working and throwing the ground about in quite another fashion to the turnover; and, used turn about with the latter, in general cultivation is excellent.

In opening up ground use upright sighting poles, two or more in a straight line; this will enable the driver to get a straight furrow at the outset. An important point in cultivation is straight ploughing; not only does it look well, but it is good, useful work in itself; it is the shortest way to the other end, thus saving time and labour. But a crooked in-and-out furrow, besides looking unsightly, is bad cultivation. It is impossible to follow all the windings of a crooked furrow and not miss turning over some land, or turning it in such a way that it lies flatly and is of very little use, and a little further on a narrow slice is turned more to the perpendicular, but leaving the land uneven, and as a consequence requiring much more trouble in preparing a proper seed bed. Ground should not be ploughed when it is too wet; far better to turn it over when it is very dry, and is often worth the extra strength required. Never mind the big clods, they will moulder away under the influence of the atmosphere and roller; but the best time of all to plough is when the soil contains about half as much moisture as it is capable of taking up. In no case should too wide a sod be turned so as to lie flatly; the slice that lies comfortably on its fellow at a fair angle, and leaving a good bed for the reception of the seed, is the proper way. For fallow land the sods should be left as near the perpendicular as possible, to admit of plenty of air. Do not plough a field in the same direction, if possible, twice following. Cross ploughing, at right angles or diagonally, is far better in every way. Toss and mix up the surface as much as you possibly can.

In entering the plough, start as nearly as possible at the same distance from the fence every time. This will save much ploughing in breadth when you come to finish headlands, so that nothing will be missed. The disc coulter is now generally preferred to the spade coulter; working through weeds and rubbish, it cuts the former cleanly, enabling it to be more thoroughly buried. Keep ploughshares well laid and mouldboards clean, or good work cannot result. New land should be well prepared for the plough, and much delay, breakages, and vexation will be avoided. When grubbing land, run all strong roots right out, and deeper than it is intended to plough. Clean off all large stones at the outset. Put on plenty of strength, for a snatchy, weak team and bad implements will never do the most useful work; they may be cheap at the start, but will be found to be much dearer in the long run.

Butter Adulteration.

Suggestions made by the Trade in England to Check Butter Faking.

1. To restrict the amount of moisture in butter to 16 per cent., in the terms of the Bill introduced by Mr. Ailwyne Fellowes last session, viz. :—" It shall be unlawful to manufacture, sell, or expose for sale any butter containing more that 16 per cent. of water, or any butter to which any substance has been added, whereby the amount of water in the butter is increased."
2. That the provisions of the Acts, 1887 and 1899, relating to the registration and inspection of margarine manufactories should be extended to butter factories; a butter factory to be defined as any place where there is plant or machinery for the manufacture or blending of butter. No person to be allowed to manufacture or blend unless so registered.
3. That inspectors should have the right of entry into all places where butter or margarine is stored or handled.
4. That inspectors should be empowered to take samples of goods in transit in private conveyances, and without having to obtain the consent of the purchaser or consignee.
5. That margarine, or any substance which might be used for the purposes of adulteration, should not be allowed on the premises of a butter factory as above defined.
6. That margarine, and any substance which might be used for the purpose of adulteration, should be mixed with sesame oil, or other detectable medium.
7. That the genuineness of all butter imported into this country should be guaranteed by the Government of the country of origin, and no butter should be allowed in unless so guaranteed.
8. That no exception should be made in favour of percentage of moisture in Irish butter.
9. That Magistrates should have discretion to imprison for second offence, and that, in the case of subsequent offences, there should be imprisonment without option of fine, and the offender's name should be removed from register.

Registration of Factory.

The section of the Margarine Act referred to reads as follows:—

9. Every manufactory of margarine within the United Kingdom of Great Britain and Ireland shall be registered by the owner or occupier thereof with the local authority from time to time, in such manner as the Local Government Boards of England and Ireland, and the Secretary for Scotland, respectively, may direct, and every such owner or occupier carrying on such manufacture as a manufactory not duly registered shall be guilty of an offence under this Act.

Inspection of Factory.

Section 7 (2) of the Sale of Food and Drugs Act, 1899, reads as follows:—

7. (2) Any officer of the Board of Agriculture shall have power to enter at all reasonable times, any manufactory of margarine or margarine cheese, and to inspect any process of manufacture therein, and to take samples for analysis.

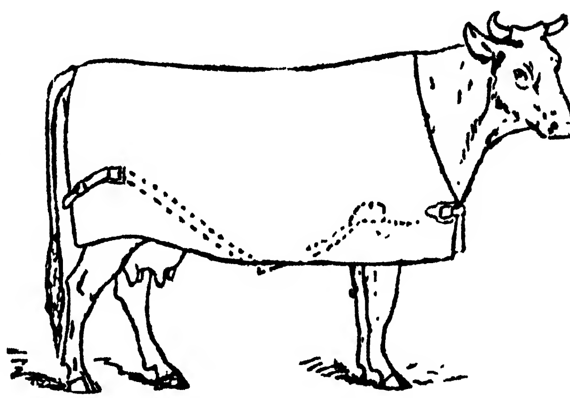
Curlews as Pest Destroyers.

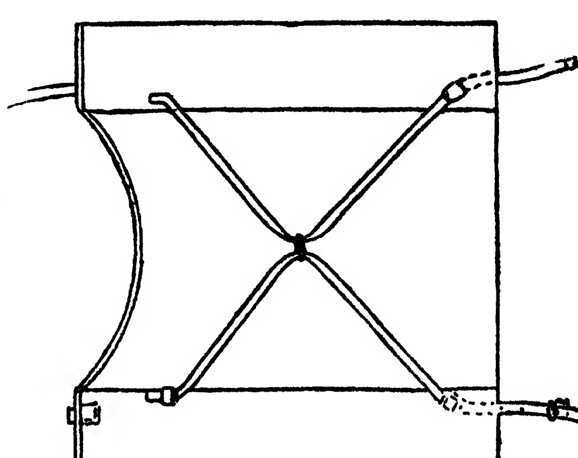
Mr. M. Hanrahan, J.P., of Black Springs, writing, some time ago, about the value of birds as pest destroyers, says: "No doubt any bird—except purely grain-feeders—will eat a grub when he can catch it; but the only bird that I found of much use for this purpose is the native curlew. The reason why this bird is such an expert amongst grubs is because it is of nocturnal habits, and so are the grubs (including the codling moth), and whilst other birds are sleeping curlews are at work. My apples were getting infested with codling moth. I got a pair of curlews and turned them at large in my garden and orchard, and the destruction they made of grubs and codling moth larvæ was surprising. As a result, I had only a few apples affected by codling moth last year, and I have no doubt that the pests will all be destroyed in another year. The ground under fruit-trees should be kept clear of weeds to give the curlews a chance."

Concerning the above, Mr. A. J. North, Ornithologist to the Australian Museum, says:—"The bird referred to is the Stone Plover (or *Œdicnemus grallarius*, Lath.), which is frequently kept in orchards and gardens to rid them of grubs, snails, and all sorts of insects. From its peculiarly mournful note, uttered usually at night, and resembling "Koo-loo," "Koo-loo," it is better known to most country residents of New South Wales under the local name of Curlew. Care, therefore, must be taken not to confound it with the true Curlew (*Numenius cyanopus*) of the coast, a bird generically and specifically distinct."

Rugging Cows.

DURING the last couple of years, a good many dairymen have adopted the practice of rugging their cows, and the results in every case are spoken of as being highly satisfactory. When cows are kept warm, the food they consume, instead of being utilised to maintain bodily heat, is largely devoted to the production of milk, and in this way the dairyman realises a large profit on the very small outlay required to provide rugs or coverings for his cattle in cold weather. Men who have studied the subject closely say that the effect of covers on cows is very remarkable. The quiet cows become more quiet and contented, while those that are shy or nervous have their nerves soothed, and submit to being handled without showing fear or timidity. There are several kinds of rugs on the market, all of which are good, but farmers can make their own rugs or covers with very little trouble. It is only necessary to utilise sound wheat sacks for the purpose, and, after they have been worn by the animals for some time, they become thoroughly rainproof. A very excellent fastening for covers is shown in the illustrations, which depict the Burge patent fastener. By this contrivance the cover is always maintained in position, and no chafing is caused. When the covers are fastened by girths only they are apt to be displaced.—*Australasian* and *Garden and Field.*





Crown Lands of New South Wales.

The following areas will be available for selection on and after the dates mentioned:—

For Conditional Purchase Lease—(Crown Lands Amendment Act of 1905).

C.P.L. No.	Name of Land District	Holding, &c.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
			Acres.		Acres.		£ s. d.	1906.
15	Parkes ..	Blow Clear West Holding.	..	1	1,161	Village and railway station Bogan Gate, 7 miles; Botfields Platform (in course of construction), 4 miles.	26 12 2	26 July.

Level country; soil—mostly red loam, some stiff clay; about 700 acres suitable for cultivation when cleared; timbered with box, oak, and pine, with scrub of pine, wattle, sifting bush, &c. No natural water supply.

C.P.L. No.	Name of Land District	Holding, &c.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
16	Parkes ..	Burra Burra Holding.	4,013	2	2,059 and 1,954	Village of Fifield, 4 miles; Bogan Gate Railway Station, 36 miles; Condobolin Railway Station, 24 miles.	25 14 10 and 24 8 6	26 July.

Undulating country; loose red soil; timbered with box, pine, oak, budtha, and wilga, and covered with dense scrub of pine, hop, warrior, wattle, and currawong, &c. No natural water supply; good sites for tanks exist.

C.P.L. No.	Name of Land District	Holding, &c.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
17	Wagga Wagga.	Ganmain Holding.	14,473	22	640 to 700	Ganmain, 2 to 10 miles.	25 3 10 to 28 16 10	12 July.

Mostly flat country, a proportion undulating; the greater part consists of free-working red clay loam, good quality, rather poor clay subsoil; timbered mostly with pine and ringbarked box; first-class grazing land, suitable for wheat-growing. Rainfall, about 21 inches.

For Original Conditional Purchase only—(Classified under Subsection 1A, Section 4, of Crown Lands Amendment Act, 1905).

Name of Land District.	Name of Holding, &c.	Parish.	County.	Total Area.	Price per Acre.	Date available.
				a. r. p.	£ s. d.	1906.
Lismore* ..	Within Tintenbar Suburban Lands.	Ballina .. .	Rous . .	13 2 9	7 0 0	9 Aug.

Basaltic formation, with rich red soil; timbered with dense bush and box; steep and stony; suitable for grazing purposes; water not permanent, but could be made so by sinking 10 to 15 feet.

Name of Land District.	Name of Holding, &c.	Parish.	County.	Total Area.	Price per Acre.	Date available.
Picton	....	Cumbertine ..	Camden ..	40 0 0 and 40 0 0	1 10 0 and 2 0 0 per acre respectively.	12 July.

Residential areas on the Southern Railway line, between Balmoral and Buxton platforms; parts suitable for fruit growing.

Name of Land District.	Name of Holding, &c.	Parish.	County.	Total Area.	Price per Acre.	Date available.
Young*	Within Young Population Area.	Young .. .	Monteagle ..	42 2 0	3 10 0	23 Aug.

Undulating country; gritty, brown soil; timbered with box, gum, and apple; suitable for cultivation; good grazing land.

* Identical with special area, see page 758.

For Original Conditional Purchase and Conditional Lease in virtue thereof—(Classified under Subsection (b) Section 4, of Crown Lands Amendment Act, 1905).

Name of Land District.	Name of Holding, &c.	Parish.	County	Total Area.	Price per Acre.	Date available.
				a. r. p.	£ s. d.	1906.
Bathurst ..	....	Waltham	Roxburgh ..	771 0 0	0 15 0	19 July.
Being portions 66, 69, and 70, consisting of stony spurs and ridges; thickly timbered with gum, apple, &c.; suitable for grazing.						
Bathurst ..	....	Crete . ..	Westmoreland.	599 1 0	0 11 8	12 July.
Thickly timbered land; partly grazing, suitable for homes for persons having employment in the district.						
Bellingen ..	....	Wonga Wonga, Ucombe, and Coff.	Fitzroy .	6,200 0 0 and 3,500 0 0	0 15 0. and 1 0 0	19 July.
Principally rough broken country covered with scrub and heavy timber, suitable for dairying when improved.						
Braidwood .	... .	Currambene	Dampier ..	190 0 0	1 0 0	12 July.
Permanently watered, suitable for grazing.						
Carcoar	....	Dunleary ..	Bathurst .	2,800 0 0	1 0 0	5 July.
Fair to good grazing land; thickly timbered, mountainous and hilly country of granitic formation.						
Gundagai ..	Yabtree Holding .	Yaven	Wynyard .	200 0 0	0 13 4	16 Aug.
Grazing land; thickly timbered.						
Gunnedah ..	Bundulla Holding..	Bundulla . .	Pottinger .	720 0 0 591 1 0 and 100 0 0	0 15 0 0 13 4 and 2 0 0 per acre respectively.	16 Aug.
Poor to good grazing land, mostly steep and broken country.						
Murrurundi	... .	Timi . ..	Buckland .	141 1 0	2 10 0	23 Aug.
Grazing land; timbered with apple, box, gum, &c.						
Singleton .	. .. .	Milbrodale	Northumberland.	1,235 0 0	1 0 0	16 Aug.
Fair grazing land, mostly hilly country; timbered with ironbark, stringybark, &c.						
Tamworth ..	....	Gill and Gulligal	Inglis and Darling.	4,780 0 0 2,000 0 0 and 2,500 0 0	0 5 0 0 15 0 and 0 18 4	5 July.
Poor to fair grazing land; rough, mountainous, and hilly country of granitic and basaltic formation						
Tenterfield ..	Deepwater Holding	Romney . ..	Clive . ..	280 1 0	1 5 0	* 2 Aug.
Fairly open forest granite country, suitable for grazing.						
Tumut .. .	Dutzon Holding	Hillas	Wynyard ..	575 0 0	0 18 4	9 Aug.
Fair to good grazing land, part suitable for cultivation; steep to undulating, granitic ridges; thickly timbered.						
Young	.. ..	Bendick Murrell .	Monteagle .	320 0 0	0 13 4	19 July.
Fair grazing land; timbered with ring-barked stringybark, part suitable for dairying; about 200 acres of low grade wheat land.						

Special Area Conditional Purchase.

Deniliquin Land District, within Deniliquin Population Area, 70 acres, distant 5½ miles from Deniliquin; maximum and minimum area, 70 acres; flat country, scattered and open timber, red sandy loam, with clayey subsoil, part suitable for cultivation; no permanent surface water; price, £2 10s. per acre. Available for additional applications only on 9th August, 1906.

Lismore Land District, within Tintenbar Suburban Lands, 13 acres 2 roods 9 perches, in two portions; maximum area, 13 acres 2 roods 9 perches; minimum area, 4 acres 1 rood 9 perches; distant 7 miles from Ballina; basaltic formation, with rich red soil, timbered with dense brush and box, steep and stony, suitable for grazing purposes; water not permanent, but could be made so by sinking 10 to 15 feet; price, £7 per acre. Available for original applications only on 9th August, 1906.

Young Land District, within Young Population Area, 42¼ acres maximum and minimum areas, 42¼ acres, situated in the parish of Young, county of Monteagle; distant about 2¼ miles from town of Young; undulating country; gritty brown soil; timbered with box, gum, and apple; suitable for cultivation; good grazing land; price, £8 10s. per acre. Available for original applications only on 23rd August, 1906.

For Improvement Lease.

Eastern Division.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Upset Annual Rental per Block.	Date of Sale or Tender.
			acres.		a. r. p.	£ s. d.	1906. Sale.
632	Gunning	....	......	1	175 1 0	2 0 0	23 July.

Consists of slate ridges on the Cullarin Range. The soil is of the poorest description. Timber—Gum, stringybark, and peppermint, with scrub of these timbers. No water. Grazing capacity—One sheep to 8 acres in average seasons. Situated about 1 mile south-westerly from Cullarin Platform, and about 20 miles westerly from Goulburn Railway Station.

Central Division.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Upset Annual Rental per Block.	Date of Sale or Tender.
			acres.		acres.	£ s. d.	1906. Sale.
1414	Balranald South ..	Moolta	......	1	1,960	4 1 8	23 July.

Gently undulating; grey soil, plain and sandy soil or rises; about half open plain, the other half timbered with mallee clumps, pine, box, &c. No natural surface water; good facilities for conservation. Rainfall, about 14·52 inches per annum. Rabbits exist. Situated about 23 miles northerly from town of Balranald, and about 40 miles southerly from Swan Hill Railway Station.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Upset Annual Rental per Block.	Date of Sale or Tender.
1432	Bingara	Bangheet	......	1	1,900	4 0 0	Sale. 16 July.

Undulating, hilly, and mountainous, basalt and trappean rocks; volcanic formation; generally rock and stony black soil; timbered with ironbark, box, pine, with a little apple, and myall on frontage, undergrowth of hopbush. Permanent water in Myall Creek. Suitable for grazing only. Rabbits and other noxious animals exist on the land. Rainfall about 30 inches per annum. Situated about 10 miles northerly from Bingara, and about 28 miles southerly from Warialda.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Upset Annual Rental per Block.	Date of Sale or Tender.
1410	Coonamble .. .	Urawilkey	......	1	6,080	25 6 8	Sale. 16 July.

Level country; sedimentary formation; good, fair, and poor red sandy loams; about 3,000 acres timbered with box, pine, oak, ironbark, and gum; about 2,000 acres timbered with box pine, oak, budtha, yarran, and wilga; remainder open country, timbered with budtha, dead myall, rosewood, beefwood, wilga and young belar. No permanent natural water supply, but there are facilities for conservation in tanks. Rabbits and dingoes are numerous. Average annual rainfall about 21 inches. Situated about 25 miles north-easterly from the town and railway station of Coonamble.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Upset Annual Rental per Block.	Date of Sale or Tender.
1407	Dubbo	....	......	1	6,900	43 2 6	Sale. 9 Ju

1,500 acres ironbark, pine, currawong, oak, stringybark, and rough stony ridges; 2,500 acres open box, with light wattle scrub; 2,900 acres of mixed ironbark, pine, oak, gum, and box, and dense scrub of pine, heath, wattle, &c; sandy, stony, and gravelly soil. Temporary water supply in Wallingara and Merrygoen Creeks; good facilities for conservation. Rainfall, about 29 inches per annum. Rabbits are numerous. Situated about 9 miles north-westerly from Dunedoo, about 14 miles north-easterly from Cobborah, and about 60 miles northerly from Mudgee Railway Station.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Upset Annual Rental per Block.	Date of Sale or Tender.
290	Gunnedah	....	......	1	3,750	4 0 0	Sale. 23 July.

Steep rocky mountain ranges and precipitous gullies, trap and conglomerate formation; timbered with stunted ironbark and pine, with pine and wattle scrub; small apple and box flats along the creek, and box and ironbark ridges, box and ironbark flat, with good red soil at south west corner of the block. This area derives a sufficient water supply from Mihi and Barney's Springs Creek. The mean annual rainfall is about 30 inches. Rabbits exist, and wallabies are numerous. The land is situated about 15 miles north easterly from the town of Boggabri, about 25 miles northerly from town of Gunnedah, and about 36 miles south-easterly from town of Narrabri.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Upset Annual Rental per Block.	Date of Sale or Tender.
1411	Hay	Wariwillah	... .	1	620	2 11 8	Sale. 7 Aug.

Red sandy soil; part open plain; part timbered with box; no permanent water; good pasturage. About 32 miles southerly from town and railway station of Hay, and about 1 mile east of village of Booroorban.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Upset Annual Rental per Block.	Date of Sale or Tender.
1391 to 1406	Hillston and Hay .	Cowl Cowl .. .	173,130	16	1,560 to 20,480	5 9 5 to 73 15 0	Sale. Hillston, 9 July.

Red sandy soil, clayey in places; timbered with belah, pine, yarran, mallee, mallee-suckers, box, currant-bush, needlewood, wilgah, apple-bush, porcupine, pin-bush, and tea-tree. No natural surface water; good facilities for conservation. Native dogs and rabbits are numerous. The blocks are situated between Hillston and Carrathool, being about 54 miles from the latter village, which is on the Hay-Junee railway line.

FOR IMPROVEMENT LEASE—*continued*

Block Numbers	Land District or Place of Sale	Name of Holding	Total Area	No of Blocks	Area of Blocks	Upset Annual Rental per Block	Date of Sale or Tender

CENTRAL DIVISION—*continued*

Block Numbers	Land District or Place of Sale	Name of Holding	Total Area	No of Blocks	Area of Blocks	Upset Annual Rental per Block	Date of Sale or Tender
					acres	£ s d	1906
1431	Hillston	Hungtawang		1	2,000	12 10 0*	Sale 16 July

All flat country, red sandy soil and red clayey soil timbered with pine and pine scrub oak and box and in the river bends a little gum about half the area being pine and pine scrub, 70 per cent of which is dead also needlewood, apple bush and wilgah scrubs Permanent water in holes in Lachlan River Average annual rainfall about 16 inches Rabbits foxes and dingoes exist Situated about 22 miles north easterly from Hillston and about 95 miles northerly from town and railway station of Carrathool

* Inclusive of rent for use of Crown improvements

Block Numbers	Land District or Place of Sale	Name of Holding	Total Area	No of Blocks	Area of Blocks	Upset Annual Rental per Block	Date of Sale or Tender
906	Moree	Mungiebundie		1	2 603 ex railway	1 0 0	Sale 16 July

Chiefly level and undulating country with a few gravelly ridges The soil is mostly a chocolate loam Timber—thick belar and some box ironbark pine wilga and rosewood, also thick prickly pear, in some places impenetrable Water could be conserved in tanks or obtained from wells at a depth of about 50 feet Average rainfall about 24 inches per annum Rabbits and wallabies are fairly numerous Situated about 1 mile west from Weetah Station and about 10 to 13 miles east from town and railway station of Moree

Block Numbers	Land District or Place of Sale	Name of Holding	Total Area	No of Blocks	Area of Blocks	Upset Annual Rental per Block	Date of Sale or Tender
1408	Narrandera	Tubbo		1	1 716	42 18 0	Sale 16 July

Mostly undulating sandy ridges red and grey clay soil small proportion of plain timber box and pine, with pine scrub no permanent water supply good facilities for conservation by means of tanks Average annual rainfall about 15 inches Rabbits exist Situated about 2 miles westerly from Narrandera about 15 miles south westerly from Whitton Railway Station

Block Numbers	Land District or Place of Sale	Name of Holding	Total Area	No of Blocks	Area of Blocks	Upset Annual Rental per Block	Date of Sale or Tender
1413	Narrandera			1	237	18 6	Sale 23 July

Flat country one quarter black soil subject to flood balance brown clayey, grey swampy and red sandy soil timbered with gum in all stages of maturity yellow and grey box and a little pine and oak Permanent water in the Murrumbidgee River Rainfall, about 17 inches per annum Rabbits becoming numerous Situated about 10 miles easterly from Yanko Railway Station and about 19 miles easterly from Narrandera Railway Station

Block Numbers	Land District or Place of Sale	Name of Holding	Total Area	No of Blocks	Area of Blocks	Upset Annual Rental per Block	Date of Sale or Tender
122	Nyngan	Willeroon		1	20 480	170 13 4	Sale 23 July

Level and gently undulating country partly open plain lightly timbered with myall and whitewood and partly thickly timbered with box pine budtha and wilga red soil with stiff red clay sub soil water supply in Bogan River not permanent rabbits exist Situate about 18 miles from Coolabah Railway Station

AGRICULTURAL SOCIETIES' SHOWS.

1906.

Society.	Secretary.	Date.
Deniliquin P. and A. Association	L. Harrison	July 19, 20
The Lachlan P. and A. Association	Thos. Cadell	July 20
Hay P. and A. Association	G. S. Camden	,, 26, 27
National A. and I. Association of Queensland	....	Aug. 7 to 11
Forbes P., A., and H. Association	N. A. Read	,, 8, 9
Corowa P., A., and H. Society	H. L. Archer	,, 14, 15
Parkes P., A , and H. Association	G. W. Seaborne	,, 15, 16
Murrumbidgee P. and A. Association (Wagga	A. F. D. White	,, 22, 23
Cootamundra A., P., and H. Association	T. Williams	,, 28, 29
Gunnedah Show	J. H. King	,, 28, 29, 30
Northern Agriculture Association (Singleton)	C. Poppenhagen	,, 29, 30, 31
Yass P. and A. Society	W. Thomson	Sept. 4, 5
Henty P. and A Society	P. H. Paech	,, 4, 5
Manildra P. and A. Association	E. J. Allen	Sept. 5
Junee P., A., and I. Association	T. C. Humphrys	,, 5, 6
Grenfell P., A , and H. Association	Geo Cousins	,, 6, 7
Albury and Border P., A., and H. Society	W. J. Johnson	,, 11, 12, 13
Young P. and A. Association	Geo. S. Whiteman	,, 12, 13
Wyalong District P., A., and H. Association	S. G. Isaacs	,, 18, 19
Germanton P., A., and A. Society	Jas. S. Stewart	,, 19, 20
Temora P., A., H., and I. Association	W. H. Tubman	,, 25, 26
Lockhart A. and P. Society	R. O. Drummond	,, 26
Adelong P. and A. Association	J. J. McAlister	Oct. 2, 3
Lismore A. and I. Society	T. M. Hewitt	Oct. 31 & Nov. 1

1907.

Albion Park A., H., and I. Society	H. Fryer	Jan. 16, 17
Wollongong A. H. and I. Association	J. A. Beatson	Feb 7, 8, 9
Tenterfield Intercolonial P., A., and Mining Society	F. W. Hoskin	Mar. 5, 6, 7
Upper Hunter P. and H. Association, Muswellbrook	Pierce Healey	,, 21, 22, 23
Walcha P. and A. Association	S. Hargrave	,, 27, 28
Royal Agricultural Society of New South Wales	H. M. Somer	Mar. 26 to April 3

[1 plate.]

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Agricultural Gazette of New South Wales.

Fruit Canning and Bottling.

[Continued from page 661.]

W. J. ALLEN AND S. A. HOGG.

II.

In the first portion of this article, several pieces of apparatus were illustrated; in the present chapter, the description of several more fittings and apparatus for a small cannery will be given before going on to the various methods of preserving fruit. It will be understood that although many of the articles shown are of a labour saving kind, they are by no means indispensable; but

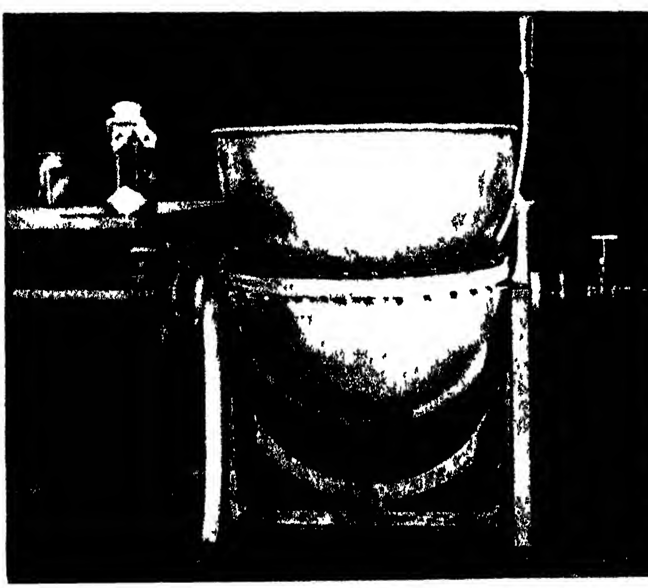


Fig. 7.—Steam-jacketed Kettle.

where the preparation of more than the usual amount of canned or bottled fruit required for domestic use is in view, a small cannery properly equipped is more or less essential to cope with a quantity of fruit during the limited time it is available.

Fig. 7.—Steam-jacketed kettle, used for cooking jam.

Fig. 8.—A convenient wooden truck with castor-wheels, for carrying tins, &c., measurement, 3 ft. x 2 ft. 6 in. x 1 ft. 3 in. high.

Fig. 9.—A handy method of storing quantities of canned fruits in the cannery.

Fig. 10.—Showing size of cans used for pulp, canned fruits, and jams. Pulp, 10 lb. and 5 lb ; canned fruit, $2\frac{1}{2}$ lb. ; and jam, 1 lb.

Fig. 11.—Glass jar, showing same wrapped with a wet towel, prior to its being filled with hot fruit or syrup ; wooden ladle and enamelled preserving-pan.

Fig. 12.—A crate of any required size, made to fit into an ordinary boiling copper, the base being of wood surmounted by a perforated-iron tray, in which the bottles are placed.

Fig. 13.—Square wooden crate, with divisions for holding glass jars during boiling.

Fig. 14.—Table on which are placed some of the accessories used in bottling, such as scales, scoops, bottle-brushes, spoons, ladle, and a strainer ; leaning up against the strainer are two perforated divisions. These are covered with cotton-wool, and placed one above the other in the box through which the syrup is strained.

Fig. 15.—Bottles in general use, showing size and the methods adopted in fastening on the tops.

Fig. 16.—Wire scalding-basket.

Preserving Fruit in Tins.

Accepting sterilisation as the medium in canning, the methods adopted are as follows :—

Peaches.—Having graded and peeled the fruit, either by hand or machine,

Fig. 8.—Truck.

halved it, and removed the stones, pack the peaches in the tins (taking care whilst doing so to place fruit so as to leave a hollow in the centre of the tin, to

facilitate the filling of the latter with the syrup); the cans should be filled with syrup to within half an inch of the top. The strength of syrup should not be less than 30 per cent.*—that is, 3 lb. of sugar to a gallon of water. Before placing on the caps for soldering, care should be taken to remove any trace of syrup that may have been spilt on the rim. This is done with a brush and hot water. In every case this detail must be attended to, otherwise the solder will not take. The lids are now soldered down, leaving a small hole in the centre. Place the cans in boiling water for seven minutes, remove, seal hole, and cook in boiling water about twenty-three minutes for freestone, and about thirty minutes for clingstone, according to ripeness. Remove and cool. Whether the tins should be immersed whilst the vent is open or kept just above the surface is not material; we prefer the latter method; at the same time, if the vent is very small it is unlikely that any water will get into the tins.

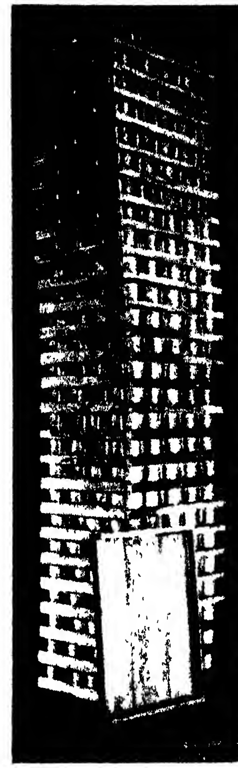


Fig. 9.—Stack of Cans.

Nectarines.—Give this fruit the same treatment and time of cooking as clingstone peaches, except that they need not be peeled unless desired.

Pears.—This fruit should be as ripe as can be conveniently handled. This can only be carried out where the fruit is brought to the cannery in a green state and allowed to ripen, or ripened in an adjoining building, giving attention to the fruit daily, and selecting from time to time those which are sufficiently ripe.

Peeling Pears.—Make a solution of a half pound of caustic soda (Greenbanks') to one gallon of water, and bring to a boil. Place in a perforated bucket or wire basket (see Fig. 16), say about two dozen pears, and immerse in the boiling solution for from three to five minutes, according to ripeness. Remove and wash in fresh water. This water should be kept running. It will be found that the skins will rub off easily by hand with the minimum loss

1 lb. 2½ lb. 5 lb. 10 lb.

Fig. 10.—Jam, canned-fruit, and pulp cans.

* In all cases the percentages of syrups given here are arrived at by measurement; these do not correspond with the densities as shown by saccharometer,—for instance, a 25 per cent. syrup by measurement reads on saccharometer 16 per cent.

of flesh. They should now be removed and placed in a weak saline or acid (citric acid) bath; the salt or acid should only just be perceptible to the palate. While in this bath they should be cut in halves, cored, and the stems removed or allowed to remain, according to choice. They need not, however, remain for any length of time in this saline solution, but may be packed directly into the cans. As the tins are packed, turn them upside down to drain. Next fill to within half an inch of the lid with syrup, 15 per cent. for Bartlett or Easter Beurré, and 25 per cent. for other canning varieties. Solder on caps, leaving a small hole in centre; exhaust by placing tins in boiling water, to within an inch of the top, for five minutes, remove, seal up hole (this in every case should be done immediately if the cooking bath is being used to exhaust in, then the cans need only be raised a convenient height and sealed in the crate at once). Cook from twelve to fifteen minutes for Bartletts or Easter Beurrés, or from fifteen to thirty minutes for other varieties. Remove and cool.

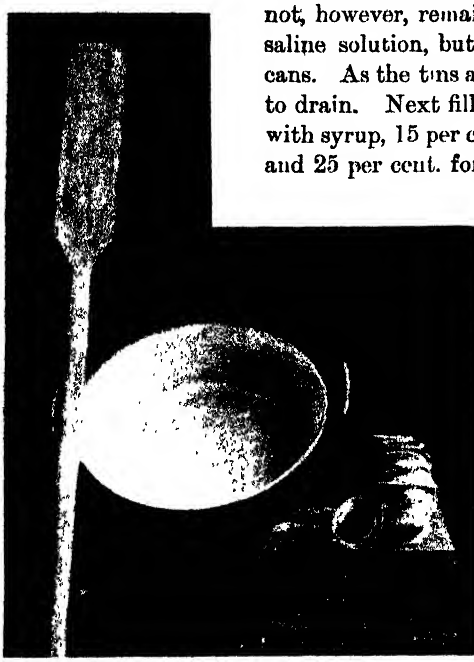


Fig. 11.

Apricots.—Select fruit of even ripeness, size, and quality; cut in halves, remove stone, wash, and pack in cans; fill cans to within half an inch of the lid, and add syrup, 30 per cent. Solder on cap, leaving a small hole in the centre of the lid; exhaust by placing cans in boiling water five minutes, seal up hole, and cook fifteen to twenty-five minutes, according to ripeness.

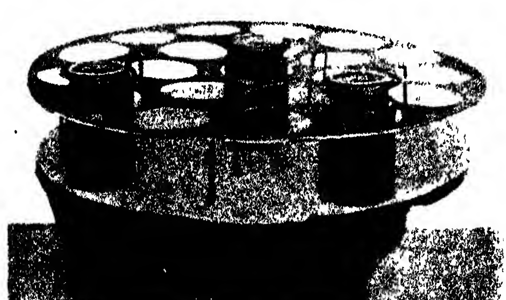


Fig. 12.—Iron Crate to hold Preserving Jars.

Plums.—Select even grade and ripeness. The stones may be removed or allowed to remain, according to size and variety. Pack in tins, fill to within half an inch of the lid; add from 15 to 30 per cent. syrup; solder on cap, leaving a small hole in the centre. Place cans in boiling water for five minutes

if stones are removed, eight minutes if stones are in fruit. Seal immediately, and cook from fifteen to twenty-five minutes. Remove and cool.

Grapes.—Select a Muscat variety (white). These should be picked before being perfectly ripe. Remove berries from the stalks, but aim at leaving the stems on the berries. Pack in cans, and fill to within half an inch of lid, with 15 per cent. syrup. Solder on lid, leaving small hole in centre; place in boiling water five minutes; seal up hole, and cook ten minutes. Remove and cool.

Quinces.—Select ripe fruit, peel, quarter, remove cores, and pack in cans; fill to within half an inch of the lid, with 30 per cent. syrup; solder on lids, leaving small hole in the centre. Place cans in boiling water for five minutes. Seal up hole, and cook thirty-five to forty-five minutes. Remove and cool.

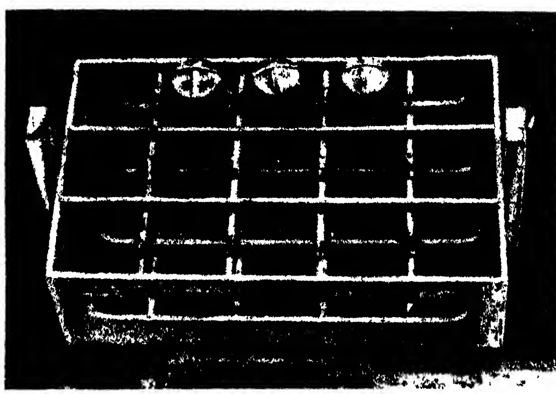


Fig. 18.—Wooden Crate to hold Glass Jars.

Tomatoes. Select medium-sized, firm, ripe, red fruit. The stems may be left on. Pack in the cans and fill to within half an inch of top with a solution in the proportion of ½ lb. salt, ½ lb. sugar, 1 gallon water. Place cans in boiling water for five minutes, seal up hole, and cook from five to eight minutes. Remove and cool.

Cleaning and Testing Cans.—As a precaution, all tins should be washed before packing fruit in them, as there is a certain degree of danger of the presence in them of chloride of zinc and other foreign matter, which at some time may become deleterious.

Testing.—In the large modern factories this is done by machinery before the tins are packed, but the smaller factories will have to resort to testing in the cooking bath. This is carried on after the tins have been exhausted and the small vent sealed. The tins are then immersed in the boiling water, and the presence of air bubbles escaping from them denotes a faulty tin, which must be removed, and the leak soldered up; then re-test the tins in boiling water.

Bottling Fruits.

The principle and process of bottling is practically the same as that of canning, the adoption of rubber rings and fastenings doing away with the necessity for solder. The fruit is packed in the bottles in precisely the same way as in the cans, and filled to within half-inch of the brim with cold or hot syrup, according to whether the bottles are going to be placed in cold or hot water. The lids in either case are fastened on, omitting the rubber rings; the bottles are placed in the crate, as shown in Figs. 12 and 13, and brought to the boil, and cooked according to the time stated as used in canning. The caps are now removed and the bottles filled to overflowing with syrup at a temperature of at least 200 degrees F., the bands put on, and immediately the caps are fastened down.

Another method is to cook the fruit in an enamelled or copper preserving-pan prior to placing it in the bottles, which should be filled immediately the fruit is cooked. But in using this method, care must be taken not to break the latter while filling. See explanation to Fig. 11.

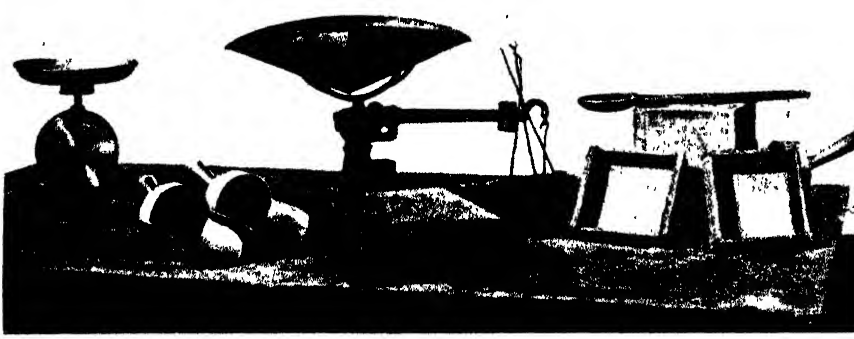


Fig. 14.—Some accessories.

Testing the Bottled Fruit after Fixing the Tops.

Ten minutes after fixing on the tops or lids, the bottle may be turned upside down; and if any syrup exudes, the bottle must be reheated, filled to overflowing with boiling syrup, a new rubber affixed, and again fastened down.

We have often been called upon to account for the presence of some fruit floating in the syrup, whilst, on the other hand, some would sink. This is easily explained, as it is simply a question of density. It is well known that it is easier to float in salt water than in fresh. The same principle applies to fruit—the denser or heavier the syrup, the more likelihood of the fruit floating. All fruits are not of the same density, and, naturally, the lighter ones float; but this becomes balanced in time by the laws of exosmosis and endosmosis, the fruit giving up its juices in exchange to the saccharine matter in the syrup.

Pulp.

This subject may be divided into two classes, viz., dry pulp, and pulp or wet pulp.

1. *Dry Pulp.*—Treating with dry pulp, the process is as follows:—Taking apricots as an example—the fruit should be ripe and well coloured; wash,

Fig. 15.—Showing various styles of Preserving Jars in general use.

remove the stone; place in cooking kettle, adding a little water at the start; boil for at least one hour: remove and place in the tins. After the tins have been filled with the hot pulp, solder down the cap, leaving a small hole in the centre; place in boiling water for ten minutes, seal the vent, test and then remove and cool. By this process the fruit becomes a mash; it loses at least a third of its original weight, and takes one hour and twelve minutes to produce.

Fig. 16.—Wire Scalding Basket.

2. *Pulp or Wet Pulp.*—This is a simpler process, saving weight and time, and in every way enhancing the appearance of the product. The fruit is cut in halves (the stones removed), washed, and packed in tins, say 10 lb.; a little fresh water is added. Solder on the caps, leaving a small hole in the centre; place in boiling water five minutes; seal up vent and cook for twelve minutes. This will produce a splendid article for either jam or pies, as the fruit will retain its flavour and original shape.

Mealy Bugs.

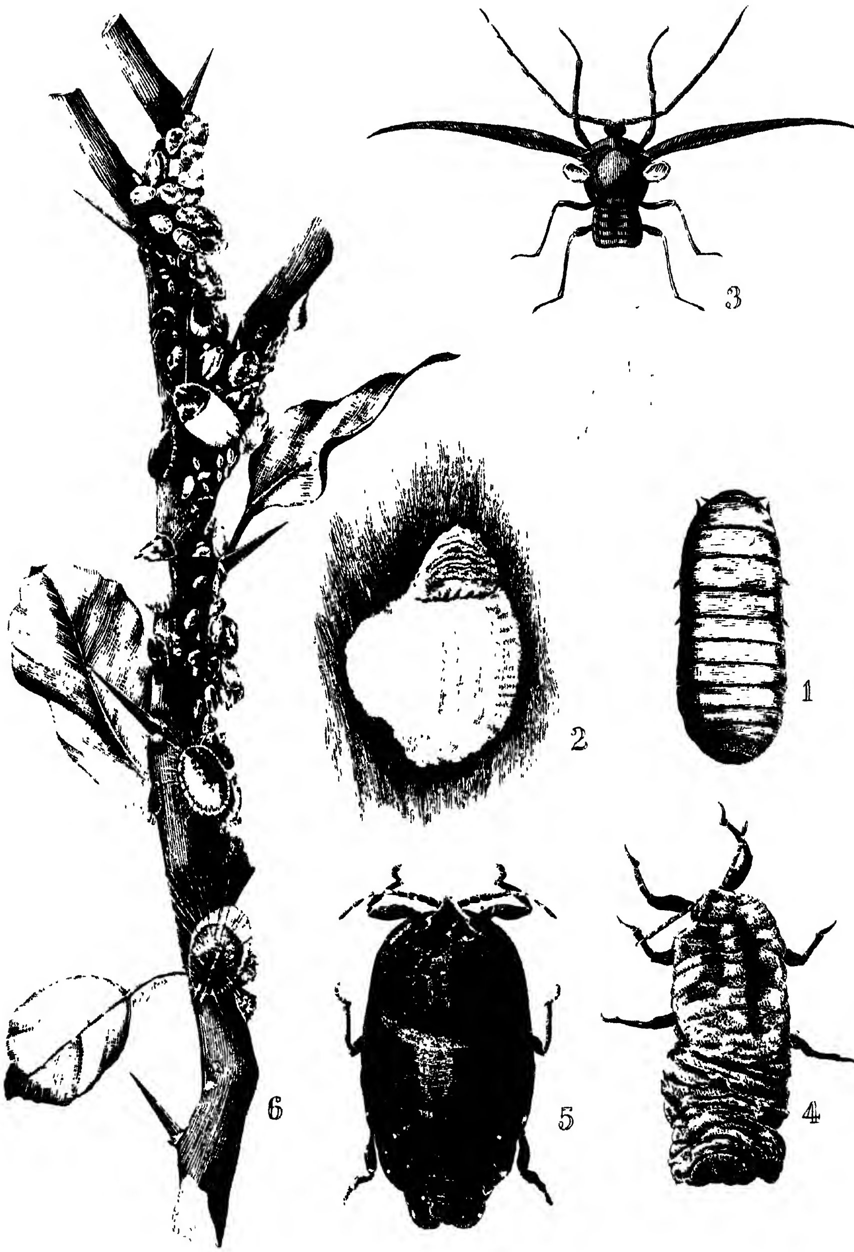
WALTER W. FROGGATT, F.L.S.,
Government Entomologist.

No. 1.—Monophlebinæ.

The popular name of "mealy bugs" is applied to several groups of the scale insects, or *Coccidae*, and what were once known as the *Monophlebinæ* are again subdivided; but in placing all the insects here noted I use it as a group name in the widest sense. During some stages of their development all these insects clothe themselves to a greater or less extent with a fine woolly or cottony secretion forming felted masses, stout filaments, slender delicate silken threads, or simply a dust of white meal. This floury or woolly substance is all produced in the same manner through minute openings on the upper surface of the body, sides, and tip of the abdomen; the fineness of the threads is regulated by the size of the apertures. The substance consists to a great extent of fine particles of pure soluble wax mixed with extraneous matter, and it is the finer woolly filaments, broken up into dust, that we see as meal or pubescence on the insects, and is also common upon a great number of scale insects. The male mealy bugs are of the usual dull-red or brown colour, with semi-opaque wings sometimes broadly striped down the outer edges and brightly tinted with rose pink; two large compound eyes; no mouth; long jointed antennæ; and in some groups the tip of the abdomen bears one or more long filaments.

The adult females are very much larger than their consorts; are of a general elongate oval, or flattened convex shape, with three pairs of well-developed legs furnished with sharp terminal claws. At first they can move about in a sluggish manner, but when once they commence to deposit their eggs they become stationary, attached to the bark, and remain afterwards simply moribund or dead carcasses. The typical genus *Coelostoma*, in which Maskell described several of our species, is now said to be peculiar to New Zealand, and as the name is preoccupied, Cockerell has changed it to *Coelostomidea*, so that the previous well-known name now drops out altogether, and the members of our fauna are relegated to Guérin's genus *Callipappus*.

In going through the descriptions of the different writers, one is struck by the fact that with the limited material in the hands of the describers it is very probable that the same species under different stages of development have in some instances been redescribed under new names. The colour, size, and even the number of joints in the antennæ are not to be relied upon as specific differences, and these are the chief points used by some in defining



MEALY BUGS

1 *Monophlebus crawfordi* (Female) 2 *Monophlebus crawfordi* (Female—showing Woolly Secretion) 3 *Callipappus austral* (Male)
4 *Callipappus australe* (Adult Female) 5 *Callipappus australe* (Female after Egg-laying)
6. *Icerya purchasi* ("Cottony Cushion Scale")

their new forms. If one could obtain a large series of species from each locality where *Monophlebus* and *Callipappus* are recorded, I should not be surprised to find that they run into each other and are simply varieties.

Though some of these "mealy bugs," like the "fluted scale," are such pests in other parts of the world, no mealy bug is a serious trouble in Australia, for our fauna is so rich in their enemies—the ladybird beetles and small internal parasites.

Monophlebus crawfordi, Maskell. (Figs. 1 and 2.)

This typical mealy bug was described by Maskell in the "Transactions of the Royal Society of South Australia," in 1888, when he named it after Mr. F. A. Crawford, who had bred numerous parasites out of the adult females and brought it under his notice. He described the male as not unlike that of *Icerya purchasi*, an insect with a red body and dark-brown wings; the dorsal surface marked with darker patches ; the thorax smooth, with the abdomen cylindrical and segmented. The female is light brick-red, with two longitudinal stripes of dull purple extending down the whole length of the dorsal surface, and also showing on the abdominal segments beneath. She is flattened, slightly convex, and broadly oval, with the dorsal surface regularly segmental ; when full grown she measures three quarters of an inch in length, and is very broad in proportion.

It has a very wide range over Australia, and has been recorded from all parts except the west. I have often taken them, in the neighbourhood of Sydney and Mittagong, clinging to the stems of the smooth-barked eucalypts, such as *Eucalyptus hæmastoma* and *E. siebriana*, sometimes quite exposed, but often more or less hidden under shreds of loose bark. Though she does not clothe herself with floury or mealy secretion, the bark upon which she is resting is often dusted with this substance. I have one very fine specimen which, in captivity, while depositing her eggs produced a great but regular mass of very fine curled filaments exactly like a bit of snow-white merino wool; this mass, extending from the middle of the abdomen, was almost as large as the whole insect, and formed a felted wool-like covering over the eggs and larvæ.

In the early stages of their growth the females crawl about quite readily, but as they reach maturity seldom move at all from their resting place.

Cockerell has placed this species in Walker's genus *Drosicha*, which was created in 1858 in the British Museum Catalogue, Homoptera, for the reception of a Chinese species—*Drosicha contrahens*: but I have not been able to discover Cockerell's reason for taking our typical species out of the genus *Monophlebus*, and at present retain the old name by which it is so well known. Maskell formed two sub-species or varieties of *M. crawfordi*, differing from the typical form in the structure of the anal setæ, or filaments, and hairy clothing. The type *Monophlebus crawfordi* has the epidermis clothed with fine hairs interspersed with a very large number of circular spinneret orifices, and no long anal seta. The variety *M. levis* has the

epidermis bearing very few short fine hairs and many similar orifices, great numbers of short sub-conical spinneret tubes, and no long anal seta.

The third form he called *M. pilosior*, which is somewhat more mottled on the dorsal surface, which is very thickly clothed with strong hairs, only a few circular spinnerets, and a long white seta protuding from the abdominal extremity.

Monophlebus fuscus, Maskell.

This is a smaller species than the last described by Maskell in the "Transactions of the New Zealand Institute," 1892. It measures under a quarter of an inch in length; is of a more brownish tint; has short rather conical seven-jointed antennæ, with the third longest and the rest sub-equal : the epidermis is clothed with many slender hairs. In the typical *M. crawfordi* the antennæ are composed of nine joints.

Maskell says: "I should have hesitated a long time to consider this a distinct species on account of the seven-jointed antennæ, which suggested an immature condition, had it not been that one of my specimens produced a great number of larvæ."

The specimens were collected by Mr. Koebele in New South Wales upon eucalypts. I have never seen this species.

Cockerell has created a new genus to contain this species, which he considers to be different from the others, and calls it *Monophlebulus fuscus* in "The Entomologist," 1902.

Monophlebus illigeri, Westwood.

Westwood described the male of this species only, in his "Arcana Entomologica," Vol. I, 1841, where he figured it and several others in colours. It is a dark-coloured insect, with the hind margins of the thorax and abdomen reddish, brown, the legs black, and the elongate wings fuscous, marked with red, and hyaline behind. It is a very small species, with the wings considerably under half an inch across, and the body about one-eighth of an inch in length. It is recorded from Tasmania.

The Red Clover Mealy Bug (*Palæococcus nudatus*, Maskell).

Maskell described this species as *Icerya nudata*, from specimens collected by Olliff on *Cosmos* and *Verbena* in Sydney gardens, where they were reported to be doing considerable damage ("Transactions of the New Zealand Institute," 1896). In 1896, when visiting the Northern Rivers district, I found a patch of red clover near Lismore thickly covered with the adult females of this scale, though the plants did not seem to be affected by their presence.

The adult female is yellowish-red on the thoracic portion of the body, with the abdominal segments brick-red, but the whole insect is usually so thickly clothed with white meal that these distinctive colours do not show through. The body is thick, convex, and swollen, covered with very fine short hairs, and measures about one-fifth of an inch in length. She has no ovisac, which is not required as the insect is viviparous, and the larvæ can be found within the body.

The Floridan Mealy Bug (*Palæococcus rosæ*, Riley and Howard, var. *Australis*, Maskell).

This species was described in "Insect Life," Vol. III, 1890, by Messrs. Riley and Howard, who illustrated its life history with drawings of the female in all stages of development. It was reported to infest roses in the Key West district, Florida, where it caused the leaves to fall off and the branches to dry up, and in consequence was looked upon with alarm by the rose propagators.

In 1893, when collecting in the bush at Cook's River, near Sydney, I found a number of bushes of *Hakea acicularis*, whose branchlets were covered with these large oval dull reddish-brown coccids with the edges fringed with white filaments, and the coccids were much more naked and scattered over the foliage of the plants than those shown by Riley and Howard on the rose leaves and stem. Shortly afterward, when carefully hunting for this scale insect, I found it common on *Grevillea buxifolia* as well as the *Hakea*, and found that it extended well over National Park.

Mr. Maskell, who identified my specimens, has recorded this find—"Transactions of the New Zealand Institute," 1903. He describes the adult female and larva, and while placing it under *Icerya rosæ* points out that there are some differences from the typical form. He says: "The differences lie, first, in the yellow dorsal spots of the adult female, and in the ten-jointed antennæ of that stage; and, secondly, in the arrangement of the hairs on the larva." The male is dark red, with markings on the head, centre of the thorax, and the whole of the abdomen lighter red; the wings are dull brown, opaque, and finely crenulated, with the costal area thickened into a broad parallel stripe of reddish-brown; the antennæ consisting of sixteen joints, tufted with long reddish hairs; and the whole insect lightly clothed with woolly filaments, thickest on the abdomen, with the anal extremity furnished with a tuft of scattered long hairs. In the larval state it is attached to the leaf, enveloped in a loose woollen sac; the adult male measures one-eighth of an inch in length. In 1896 Maskell described, in the same journal, the male insect from specimens I sent him bred out in Sydney, in which he remarks how closely it resembles the male of *Icerya purchasi*.

The Cottony Cushion or Fluted Scale (*Icerya purchasi*, Maskell). (Fig. 6.)

In 1855, Professor Westwood described a "Mealy Bug" in the *Gardeners' Chronicle* under the name of *Dorthesia seychellarum*. It was sent to him from the Seychelles Islands, where it was found damaging the sugar-cane. It was again described by Guérin in 1867, under the name of *Coccus sacchari*, on account of its infesting the same plant; and has since been recorded from Mauritius, China, Formosa, Madeira, and New Zealand, where it has spread to palms, guava-trees, roses, oranges, and Podocarpus. In 1875, Dr. Signoret, when monographing the different groups of the mealy bugs, discovered that this insect did not fit into the genus *Dorethesia*, so he redefined the type and created a new genus *Icerya* for its reception. In 1878, Dr. Purchas found a mealy bug covering the foliage of a hedge of Kangaroo Acacia in the

neighbourhood of Auckland, New Zealand. He informed Mr. Maskell that it had only lately appeared in Auckland and was as yet only to be found upon one hedge. Maskell described it as a new species of *Icerya*, and named it after the discoverer ("Transactions of the New Zealand Institute," 1878). He says: "The plants, I may say, were nearly destroyed by the insects, which covered them in great numbers, and the large size and peculiar appearance of the pest was very striking."

In 1887 Maskell published his "Scale Insects of New Zealand," and said that this pest had spread with such rapidity that it was a very serious trouble in Auckland, and had spread all over the orchards and killed out hundreds of orange trees. At Hawke's Bay it was a more universal pest, attacking all kinds of plants.

Though this insect was not noticed or described until 1887, it is said to have been established in San Mateo County, California, in 1868; in 1886 it was found in many parts of the State and spreading rapidly; at San Diego the County Board had set to work and nearly exterminated it, but northwards it was found as far as Sacramento. It increased so rapidly and damaged the citrus orchards so seriously that it was soon looked upon as one of the worst pests that had ever struck the Californian fruit-growers. All kinds of remedies were tried to destroy this scale, and in the year 1886 the Los Angeles County Board of Horticulture offered a reward for a remedy that would prove an absolute exterminator. The reward tempted a great many competitors, and great efforts were made at the trial of the remedies, but even the best of them failed to accomplish the desired result.

Among the assistants who were working against this pest was Albert Koebele, who, with Professor Riley, had noticed several parasites attacking the coccid, and when the question of its native home was raised and the chance of getting the parasites to clear them out was suggested, he was chosen to visit Australia and New Zealand, and accomplished his mission in a most remarkably successful manner. His report of a trip to "Investigate the Natural Enemies of the Fluted Scale." was published as *Bulletin* No. 21, Division of Entomology, United States Department of Agriculture, 1890. In this trip, followed by others at Mr. Maskell's suggestion that Australia was the native home of *Icerya purchasi*, Koebele found (1888) a number of adult specimens of this scale upon the *Pittosporum* bushes in the Town Hall garden in Sydney, and upon an acacia in the Botanic Gardens. He found it in about the same numbers around Melbourne, but in Adelaide, South Australia, he found it somewhat more abundant, but this was probably because he was accompanied by Mr. Frazer S. Crawford, who had been working at this scale and its parasites some time before. Among the specimens of the scale that Koebele collected in Sydney, he bred out a small black fly, which was submitted to Dr. Williston, who described it as a new species (*Lestophonus iceryæ*).

My experience of the Cottony Cushion Scale dates from 1889, when with Mr. Skuse (who wanted specimens to breed the parasites) we collected a

number of the adult females on the bushes round the Town Hall. Since that date, while collecting all over Australia, I have observed this characteristic scale under many conditions, and find that it is confined to the coastal districts, round the larger towns, and in the vicinity of Sydney can be obtained in some stage of growth all the year round, but in no place is it a pest, even when it is occasionally introduced into an orange orchard upon young trees from a dirty nursery—it only congregates under the shelter of the bandage where the young tree is tied to the stake, and is very easily destroyed. In the bush one now and then finds it upon the black wattle (*Acacia decurrens*), but it is not common, though upon a cultivated specimen of the same wattle it sometimes covers the foliage. In our gardens odd specimens are often seen upon rose bushes, and wherever a "Cootamundra wattle" (*Acacia Baileyana*) is growing, one can always depend upon finding this mealy bug. Sometimes it completely covers the whole of the foliage, but before the summer is well advanced the many parasites (chiefly minute flies) have cleaned the bulk of them off, without any apparent damage to the tree.

This mealy bug was first recorded from South Africa by Mr. Roland Trimen in 1877, where it was called the "Australian Bug." He stated that he had first noticed it in the Botanic Gardens at Cape Town, in 1873, and at the time when his report was issued it had spread over all parts of the eastern province of Cape Colony. Ten years later Bairstow informed Miss Ormerod that it had reached Bloemfontein, and ranged across 680 miles of country. It is worthy of notice that in California and South Africa there was hardly a plant or tree that it did not infest and damage, though in Australia it is confined to about half a dozen shrubs.

In Mr. Fernald's "Catalogue of the Coccidæ of the World," 1903, there are fifty-five references given of papers dealing with *Icerya purchasi*, and its present range, besides the places already mentioned, extends over Fiji, Sandwich Islands, Portugal, Trinidad, and Mexico. The actual original home of this insect has never been satisfactorily settled. It was known in California as far back as 1868, ten years before it was discovered in New Zealand, and as far as Australia is concerned it was quite a garden or park insect, even when Koebele looked for it. Certainly scale insects had not been sought for or collected in any systematic manner in Australia at that date, but such a conspicuous mealy bug, if abundant, would have attracted someone's attention. The reason that no mealy bug is a pest in Australia would also apply to this; for we have such a large number of predaceous ladybird beetles in our insect fauna, that though mealy bugs may appear at times in considerable swarms, the beetles also increase and check its spread—besides the internal parasitic flies and wasps that we also find destroying it. Therefore, though in Africa it was christened the "Australian Bug," and the Americans firmly believe it to have emigrated from Australia, we may just as easily have received it from America or New Zealand with imported plants.

The adult mealy bug is of a dull red colour, with black legs and antennæ; the head and thoracic portion are flattened sloping down in front and almost

circular, with the abdominal segments clothed with a thick coat of woolly filaments, closely felted into a rounded oval mass extending beyond the tip of the abdomen, this white wool being regularly grooved into parallel hollows and ridges giving the wool a regular fluted or corrugated very characteristic appearance. In front of the wool on the hind margin of the thoracic segments is a fringe of long silvery hairs or filaments, with similar ones standing out in front of the head; and in the final stage, the dorsal surface of the head and thorax is clothed with irregular lumps of woolly matter entirely hiding the colour and structure below. A well-developed specimen will measure half an inch in length. The eggs are deposited beneath and among the felted woolly matter covering the abdomen, which gradually withers away into a dry shell as the eggs are discharged. Many different estimates have been made as to the number of eggs that each female can lay, and they probably vary—from several hundred to a thousand have been counted. The newly-hatched larvæ are dull red, with very long black legs and antennæ, the latter clubbed at the tips, and the who'e clothed with long white silvery filaments. After the female larva settles down to work on the surface of the plant she sticks her beak in and begins feeding upon the sap below, and becomes an oval creature throwing out woolly secretion that gradually covers her, flattened on the fore part of the body, with the hind portion ridged or fluted in a regular pattern. The male is a delicate typical two-winged creature of a general orange-red tint; has darker brownish tinted antennæ, consisting of ten joints fringed with long hairs; the wings, two in number, are smoky black, and the abdomen is of a uniform thickness, forked at the extremity, and tufted with long filaments.

Koebele's Mealy Bug (*Icerya Koebelei*, Maskell).

In 1892 Maskell contributed a paper to the *Entomologist's Monthly Magazine*, entitled "A New Icerya, and some other New Coccids from Australia," followed by a more scientific description, with figures, in the "Transactions of the New Zealand Institute" in the same year. This species, which is a rare one, was collected by Koebele in New South Wales, who sent them to Maskell. It can be easily distinguished from the common species by its smaller size, as the adult female is only one-tenth of an inch in length. Maskell says: "But the distinguishing feature is that, from the central region of the dorsum in the adult female, there springs a rather thick pencil of cottony fibres, white or slightly tinged with yellow, and protruding, in the specimens observed, one-sixteenth of an inch. This is a very peculiar feature not seen in any other coccid that I know of."

Maskell records this species upon *Leptospermum laevigatum*, and a wattle. I have taken single specimens upon mangrove in George's River, Oatley, and upon *Leptospermum* at Bankstown, New South Wales.

The Egyptian Mealy Bug (*Icerya ægyptiacum*, Douglas).

In 1890 Admiral Blomfield forwarded a number of specimens of a mealy bug to the Royal Gardens of Kew, stating that he had first observed it about four years before on the leaves of a banyan tree at Cairo; but since then they

had spread all over different trees and plants, and were doing an immense amount of damage in the gardens of Cairo and Alexandria, Egypt. The authorities at Kew Gardens handed these specimens over to Mr. J. W. Douglas for determination. He did not consider, from the material he had to examine, that it was a true *Icerya*, and so created a new genus for its reception, calling it *Crossotosoma ægyptiacum* (*Entomologist's Monthly Magazine*, 1890). This description was republished in the Kew *Bulletin*, No. 41, of the same year, with an interesting account of the habits of the pest.

In the same year Messrs. Riley and Howard ("Insect Life," Vol. III, No. 1, 1890) published a paper, entitled "Some New Iceryas," in which they described two new American species, and redescribed this species, placing it in the genus *Icerya*. Later on Mr. Newstead, of Chester, recorded it from Madras, India, having received numerous specimens from a correspondent.

While collecting insects at Penshurst, near Sydney, I discovered a number of mealy white coccids, new to me, infesting the undersurface of the leaves of a small native shrub (*Goodenia ovata*), which I later on forwarded to Mr. Maskell, of New Zealand, who immediately recognised them as the Egyptian mealy bug. I examined these plants all round the district many times, but failed to find any more specimens, and shortly afterwards a bush fire swept over the exact spot where they were obtained, and I have no record of it since. The female coccid can be easily recognised and separated from the common *Icerya purchasi*, for it is more oval and flattened, with the felted woolly filaments forming irregular finger-like tufts straggling round the body, longest behind, and short and thickened in front.

The Bird of Paradise Coccid (*Callipappus* [*Coelostoma*] *australe*, Maskell). (Figs. 3, 4, 5.)

This insect was described by Maskell in the "Proceedings of the Linnean Society, New South Wales," 1890, from specimens obtained by Mr. Olliff upon "Apple-tree gum" (*Angophora*), near Sydney. He figures both sexes, but the drawings are poor, and do not do justice to the beautiful fairy-like male insect.

The male is under a quarter of an inch in length, with a wing expanse of two-thirds of an inch, of a uniform dull red colour, with the wings bluish-purple to rose-pink at the base, the nervures red; the tip of the abdomen furnished with a bunch of spun glass-like filaments spreading out into a beautiful tail, often fan-shaped, reminding one of the plumes of a bird of Paradise. When flying in the bright sunlight, it has a very curious appearance with this remarkable tail spread out. Koebele discovered a number in the pupal state on the ground among eucalypts, between leaves and under bits of bark, enclosed in a mass of cottony secretion. Maskell bred these out in captivity, when he was able to watch them breeding out into the adult insects. He says: "The pupa itself is light red, elongated, and somewhat slender, showing rudimentary legs and feet. On emergence therefrom the adult male is also light red, the body very soft, and the wing flabby and weak. The colour deepens gradually, and the wings expand and become strong; it appears to

be a couple of days before the insect acquires its full deep red colour of the body and nervures. At first there is no sign of the caudal brush, the filaments of which commence to grow after five or six hours, and take two or three days before they reach their full development." Males kept in a box lived for a fortnight before they died.

The adult female is of a uniform dull blue-black tint, elongated, rounded at the extremities, slightly convex on the upper surface, and distinctly segmented, varying in length up to an inch. It is covered with scattered white flakes and short cottony secretion at the tip of the abdomen. The tapering antennæ contain eleven joints of nearly equal length, lightly clothed with hairs. Like other of the abnormal coccids she has no true mouth, but in place of the rostrum there is an aperture in the corrugated skin between the first pair of legs.

In the final stage the female, after depositing her eggs, is a very different-looking creature, for she is attached firmly by the undersurface of the body to the bark of the tree upon which she is resting, the legs spread out, and the thoracic portion swollen out into an irregular oval, or convex above with a rim running round the outer edge; the abdominal segments are contracted, shrivelled, and turned upwards at the tip. It is smooth on the dorsal surface of the bloated thorax; of a dull reddish-purple tint, with a deeper red on the junction of the legs and antennæ; and a few flakes of white meal are scattered over the upper surface, thicker on the under side. I have frequently taken them stiff and dead thus attached to the trunks of White gums.

In the summer time the active female often crawls up on the top of a stump or log in the scrub about Sydney, and, if found in this position, one will, if he remains in the vicinity without disturbing her, soon see one or more males, with their remarkable tails spread and glittering in the sunlight, flying round the spot, evidently attracted by some subtle scent or odour.

Maskell placed this insect in the genus *Coelostoma,* which he had created for a number of mealy bugs peculiar to New Zealand; but later writers consider that it properly belongs to Guérin's genus *Callipappus*, which he created for the reception of a new "mealy bug" from Western Australia, which he called *Callipappus westwoodii* ("Revieu de Zoologique," 1841).

Callipappus westwoodii, Guérin.

This mealy bug was described from Western Australia by Guérin in the "Revieu de Zoologique," 1841, taken upon eucalypts. It was redescribed by Signoret in 1875 in the "Annales of the Entomological Society of France." Fuller, in his paper in the "Transactions of the Entomological Society of London," in 1899, describes it as a common species, and also gives an account of its habits.

Guérin describes the female as about half an inch in length; of a brownish-black colour, covered all over the body with a fine pubescence of a silky yellow; the male, very much smaller, is of a dark reddish-brown colour, with rather large delicate wings.

Callipappus farinosus, Fuller.

In Fuller's paper on the "Coccids of West Australia," published in the "Transactions of the Entomological Society of London," 1899, he described a number of species he had previously briefly noticed in a paper, "Notes on Coccidæ of Western Australia," in the *Agricultural Journal* of that State in 1897. Among the insects described is Guérin's, Ménéville's *Callipappus westwoodii*, which he described as common, and two new species. *Callipappus farinosus*, in the adult female state, measures one inch in length; is of a general claret-brown colour; the body viewed from above is elongate ovate, clothed with fine mealy flakes, with ten-jointed antennæ; and the thoracic segments are indicated by transverse bands of red.

A second species, *C. bufo*, in structure and form agrees in all particulars with (by description) the final stage of *C. australes*; and I should not be surprised to find that further investigation would show that it was the moribund or dead form of *C. farinosus*.

Callipappus (Coelostoma) rubiginosum, Maskell.

This insect was figured and described by Maskell ("Transactions of the New Zealand Institute," 1892) from specimens sent to him from Victoria, upon twigs and leaves of a honeysuckle (*Banksia integrifolia*), and he afterwards received specimens from South Australia.

I have not seen this species, which is probably confined to the south. It is described as about two-thirds of an inch in length, of a dark reddish-brown colour, but covered with short slender filaments giving it a rusty tint; the body is irregularly wrinkled, with a ridge running round the outer margin. Maskell says that it is allied to the large species, *Coelostoma immane*, he described from Central Australia. The male or larval forms are unknown.

Callipappus (Coelostoma) immanis, Maskell.

Among the many specimens that Mr. F. S. Crawford sent to Mr. Maskell for determination were some specimens of a large female mealy bug obtained from a shepherd, who had collected them upon the twigs of a wattle (*Acacia aneura*) in the central portion of South Australia.

Máskell described it in the "Transactions of the New Zealand Institute," 1891, calling it *Coelostoma immane* on account of its large size. He described it as dark red to reddish-brown in colour, sometimes nearly black, and varying in size from one-third to an inch in length. His material was not in good condition and had been in spirits, so that he could not say how much cottony secretion covered the living specimens.

In 1899, Mr. Tepper contributed a paper to the "Transactions of the Royal Society of South Australia," in which he described the male of this mealy bug, obtained from a fine series of males and females attached to the twigs of the same acacias, that were sent to the Adelaide Museum from Port Augusta in a living state. He redescribed the female as having the whole body thinly covered with white meal, which also dusted the twigs upon which they were clinging; and gives the measurements of the largest as upward of 1½ inches in length. The males had the typical bluish-black bodies and rose-coloured wings.

Artesian Irrigation.

[Continued from page 665.]

W. R. FRY,
Manager, Moree Experimental Farm.

III.

Will it Pay?

THE average pastoralist, with some few exceptions, generally considers the artificial conservation of fodder as very good in theory, but rather difficult to practice. Although usually satisfied when an extra rainfall causes a luxuriant growth of grass and herbage, he does not always consider it an unmixed blessing, as it means plenty of burrs and grass seed in the next

Irrigated Sorghum. Showing the daily ration. Sheep-feeding Experiments.

wool clip, and a risk of fire to the sheds and fences from the unused dry grass. This occasional superabundance of feed affords an opportunity for a little speculation in stock, or the grass lands may be leased to a less fortunate neighbour, who is either overstocked or has missed the summer thunderstorms. To conserve the fodder in the form of bush hay or ensilage, although frequently suggested, is seldom practised, chiefly owing to the absence of the necessary implements and a limited experience in harvesting operations. It is true some stacks of hay were made in the good season following the drought; but in many cases they were utterly useless, owing to attacks of

mice, want of thatching, or imperfect building and curing, whilst methods of ensilage-making are practically unknown. It is therefore not surprising that to the question of producing irrigated crops (even by the settler who already has bore-water available) is returned the emphatic answer, "It won't pay."

Of course, if it pays better in a dry time to send the stock away to the New England pastures, which are not always available, the stock-owner will not trouble about irrigation; but it is probable that, as the area of grass lands in the cooler districts becomes reduced by the increasing demand for agricultural purposes, that the cultivation of irrigated fodder at home will pay handsomely.

In order to get some idea of the actual cost of feeding stock in a dry time, an experiment was recently conducted at the Moree Experimental Farm, the results of which may throw some definite light on the subject. It was suggested by some of the district settlers during a discussion on the well-known Jemalong sheep-feeding experiment (*Agricultural Gazette*, Vol. XIV, Part 5) that a similar local demonstration with bore-water would be useful, and perhaps assist in removing the prejudice against its more extensive use. Accordingly, on obtaining permission from the Department in October, 1905, 5 acres of black soil were prepared and sown with Amber-cane sorghum, which crop had hitherto given the greatest amount of fodder per acre under existing conditions. There was, also, a certain amount of prejudice against the use of sorghum as a fodder crop, and many local wiseacres predicted that, being grown with bore-water, the feed would be too sour, and would poison all the sheep, or make them wormy; but all such ideas were ultimately proved to be fallacies.

The cost of growing the 5 acres of crop (at rate of 6s. per day or 9d. per hour for labour), exclusive of interest on implements and bore, was as follows:—

		£	s.	d.
18 Oct.	Ploughing, 8 hours, at 9d. per hour	0	6	0
19 and 20 Oct.	,, 16 ,, ,,	0	12	0
23 and 24 Oct.	4 hours per day	0	6	0
25 Oct.	Rolling, 7 hours, at 9d. per hour	0	5	3
26 Oct.	Sowing, 6 hours	0	4	6
27 and 28 Oct.	Ridging, 11 hours	0	8	3
30 Oct. to 9 Nov.	Watering (1 hour morning and night) 2 hours daily for 10 days, equal to 20 hours	0	15	0
Dec.	Cultivation (1 horse), 9 hours	0	6	9
8 and 13 Jan.	Second waterings, 2 hours for 5 days, equal 10 hours...	0	7	6
	Total labour, cost of 5 acres	3	11	3
	Cost of seed, 60 lb. at 4d	1	0	0
	Freight on seed	0	2	6
	Cost of 5 acres	£4	13	9

The seed was sown at the rate of 12 lb. per acre, with the ordinary wheat drill, by blocking all the drills except the middle and each end, and thus sowing three rows at a turn.

The Moree Pastures Protection Board kindly lent 700 yards of 3 ft. 6 in. wire netting to make a secure camping paddock, and the local branch of the Farmers and Settlers' Association promised to lend 250 four-tooth wethers for the feeding test. A number of local gentlemen (including J. T. Crane, Esq.,

Mayor of Moree; J. Cameron, Esq.; W. Woods, Esq., President, and A. C. Bramma, Esq., Secretary, of the Farmers and Settlers' Association; J. T. W. Scott, Esq.; J. B. Cramsie, Esq.; E. R. Scott, Esq., Stock Inspector; and J. Lillyman, Esq., J.P.) formed a Committee to assist with their practical advice during the experiment.

Sorghum being irrigated for second growth.

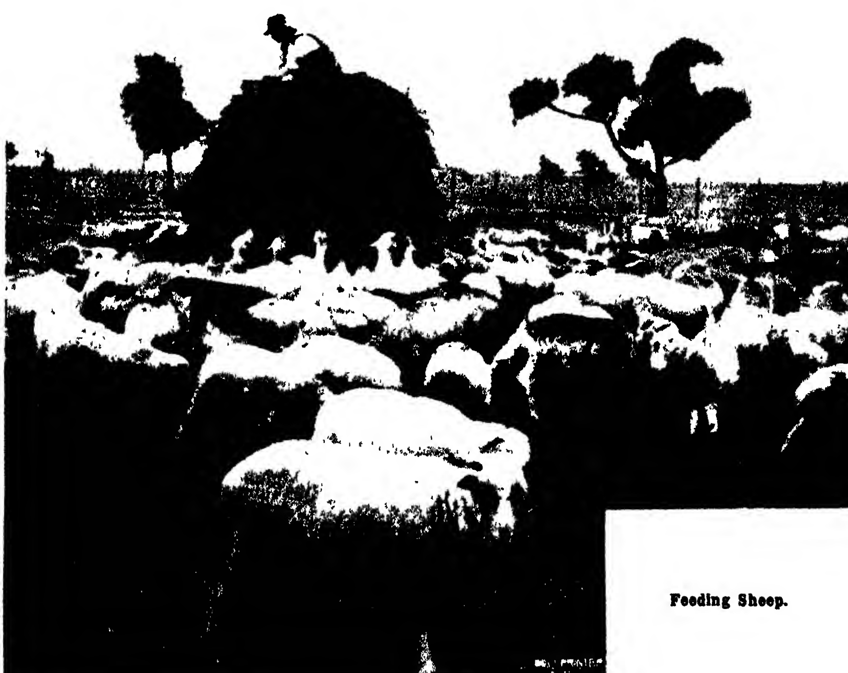
During December and January, and especially after the second watering, the crops grew so fast and thick that it was most difficult to cultivate between the rows. The rainfall during the growing period of the first crop was as follows:—

1905.		1906.	
17 November	33 points.	9 January	64 points.
19 ,, ...	45 ,,	12 ,, ...	34 ,,
20 ,, ...	13 ,,	18 ,,	6 ,,
29 ,, ...	36 ,,	31 ,, ...	11 ,,
30 ,, ...	3 ,,		
			1·15
	1·30		
		1 February	17 points.
7 December	32 points.	2 ,, ...	3 ,,
27 ,, ...	2 ,,	3 ,, . . .	15 ,,
31 ,, ...	7 ,,		
			35 ,,
	41 ,,		

Total, 3·21 inches.

The rainfall in November, coming immediately after the first watering, was practically of no use to the crop, while the inch of rain in January, falling

at the time of the second watering (8–13 January), did more harm than good. On 5th February, when the feeding commenced, the crop was from 8 to 10 feet high, and tasselling well; therefore, the whole of the first growth was due to the application of bore-water, as was proved in a few high places where the watering had been missed, and the growth was a little over a foot high. The ground had been cropped continuously and irrigated with bore-water for the previous six years, and was not manured or treated in any way, yet, in places, the crop grew to a height of 11 feet, and yielded up to 16 tons per acre from the first growth, and nearly half that amount on the second cutting. On the night of 11th February, a wind storm, accompanied by 180 points of rain, flattened down a large area of the crop, and rendered it most difficult to handle. The rain, therefore, was a disadvantage, for, although it assisted the second growth, and caused the discontinuance of another watering, it so increased the cost of cutting as to make the cost of the soiling method practically prohibitive except in a drought.



Feeding Sheep.

When the crop was ready to cut, some difficulty was experienced in obtaining the required class of sheep; but, ultimately, the feeding was commenced with 200 mixed ewes and hoggets, kindly lent by J. T. W. Scott, Esq., Challicum, and later, with 50 wethers from J. Fingleton, Esq., Bumble. It was rather unfortunate that any ewes in lamb were admitted, as the

driving and daily counting proved dangerous to the lambing ewes, and a few died from this cause, assisted by crows and the cold wet camping ground. However, when the daily counting was discontinued, this trouble was overcome; but as there were then several lambs, it was decided to remove all the ewes. These were partly replaced by 85 wethers from A. C. Bramma, Esq., Newport, but as the full number could not easily be obtained, owing to rains and plentiful feed, the feeding was continued with 200 sheep. It is satisfactory to report that no trouble was experienced after the removal of the lambing ewes, and that only one wether died throughout the time.

The sheep, which were confined in a small paddock adjoining, containing a couple of shade trees and bore-water, but absolutely bare of grass, were fed daily on one small load of sorghum, the average weight of load being 8 cwt., or about 4½ lb. per sheep. At the end of the first fortnight five marked sheep were again weighed, when it was found that the young wethers had gained 4 lb., whilst the old ewes remained about the same. However, it was not intended to fatten the sheep but merely to see how long and at what cost an acre of irrigated sorghum would feed them on a drought ration. These sheep had never seen sorghum before, but after a few days they developed a great liking for it, and eagerly followed the dray around the paddock. (*See* illustration.) It was noticed that they first picked out the seeds, then the leaves, and left the thick stalks; but after a few days, when the stalks became wilted, they came back and ate them. Towards the end of the feeding, as the stalks became drier and tougher, a greater number were left on the ground and a great deal wasted. On this account, the crop should be sown at different periods in rotation, so that there would always be green succulent feed coming on, and it would undoubtedly be better to turn the sheep on to part of the crop, and let them graze the feed themselves. It is considered, also, that if the crop had been chaffed, that a much larger number of sheep could have been fed, and there is no doubt that in a drought the extra expense of chaffing would be amply repaid.

As the sorghum seeds were so much relished by the sheep, the following analysis (from the "Farmers and Fruit-growers' Guide," page 127) may be of interest:—

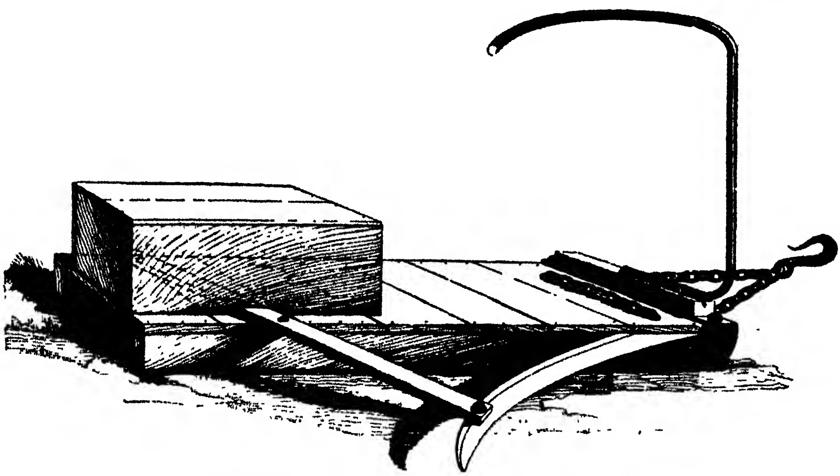
AVERAGE Composition of Feeding-stuffs—Grains.

		Water.	Ash.	Albuminoids.	Fibre.	Carbohydrates.	Fat.
Grain or seed only.	Maize	10·9	1·5	10·5	2·1	69·6	5·4
	Sorghum	12·8	2·1	9·1	2 6	70·0	3·6
	Oats	11·0	3·0	11·8	9·5	59·7	5·0
	Wheat	10·5	1·8	11·9	1·8	71·9	2·1
	Lucerne hay	8·5	7·4	14·3	25·0	42·7	2·2

It will be noticed that sorghum seed contains more fat than wheat, and more carbohydrates than oats; but it is somewhat lower in albuminoids or flesh-forming materials than the other foods.

The daily load of feed was at first cut with an implement made from a scythe-blade, bolted on to the side of a slide, which proved very effective in an upright crop, the time occupied in cutting and carting being 1½ hours at 9d. = 1s. 1½d. per day. After 11th February, when the storm flattened down the crop, no implement would effectively handle the tangled mass, which, therefore, had to be cut with a brush-hook by hand. This took 2½ hours, and increased the daily cost to 1s. 10½d. The actual labour cost of feeding was as follows:—

		£	s.	d.
Feb. 5 to 11	7 days of 1½ hours, at 9d.	0	7	10½
Feb. 12 to April 3 ...	51 ,, 2½ ,, ,, .. .	4	15	7½
April 4 to May 5 ...	32 ,, 2 ,, ,, ...	2	8	0
Total, 90 days		£7	11	6
Cost of growing crop, 2½ acres, at 18s. 9d.		2	6	10½
Total cost		£9	18	4½



Scythe-blade Cutter for cutting Sorghum and Maize.

During the last month the time occupied in feeding was somewhat less, owing to the removal of the ewes, the original number of 250 being reduced to 200, and later to 187. During the three months an average number of 201 sheep were fed from 2½ measured acres of the crop *at the rate of* 80 *sheep per acre*; and at the end of that time there was still over a week's feed remaining, besides another 2½ acres untouched, and the sheep left in fair store condition. Owing to the ewes lambing, and the subsequent removal of some of the marked sheep, it was not possible to continue the weekly weighings; but the owners of the sheep acknowledge their return in first-class condition, and consider that they held their own, although only fed on a drought ration. As would be expected, it was noticed that the larger-framed, wrinkly sheep did not do so well on the same amount of feed as the smaller, plain-bodied sheep, a pen of which were exhibited at the Moree Show (at the conclusion of the experiment), where they created much interest and discussion.

There is no doubt that a larger number of sheep—say 10,000—could be more cheaply fed per head than 200 could, as the feed could be cut and tied with a McCormack sorghum harvester, or the sheep could be turned into portions of the crop divided off by movable wire fences, or hessian, which has been proved successful elsewhere. It is as well, however, to compare this result, under expensive conditions, with the usual method of feeding in an ordinary dry time. Cost of renting country is often from £7 to £8 per 1,000 per month; and to this must be added the cost of droving or trucking, and sometimes shepherding. The total cost often exceeds £12 per 1,000 per month, or 3d. per head. Also, consider the loss of sheepskins, &c., while away, or chance of rain coming at the home station just after country has been rented for a term of three months. The cost of droving at the present time (June), in small mobs, is at the rate of £3 per 1,000 per week, or £12 per month of four weeks = 3d. per head. Agistment is costing about the same, taking into consideration the cost of attendance. In fact, instances can be quoted where agistment and attendance is costing £17 per 1,000 per month; but these are lines of ewes on point of lambing. The labour cost of feeding by the soiling method (that is, cutting and carting the feed) was less than 4d. per head per month, or nearly £16 per 1,000; but if the interest on the bore and implements used and the rent of land be added, it would somewhat increase the cost; so that the soiling system would be too expensive in a season like the present, although there is no doubt that in a drought it would be profitable, especially if the feed was chaffed.

During the course of the experiment a number of interested visitors inspected the sheep, one of whom (Mr. F. Kirby) gave us particulars of his experience in grazing the sheep on the crop, which definitely substantiates the opinion that the grazing system is the most economical where the feed is not chaffed. The following is an extract from a capital article in the *Moree Gwydir Examiner* of 28th March, 1906:—

"Seeing our article on the Moree Bore Farm experiment on sheep-feeding with sorghum, Mr. F. Kirby, of Messrs. Kirby Bros. of Belara, called at the *Examiner* (Moree) office, and added his practical testimony to the efficiency of irrigation by bore-water for stock feeding. Messrs. Kirby's property is irrigated from No. 1 Oreel bore, from which it is 14 miles distant.

"The particulars given by Mr. Kirby can be authenticated by any of his neighbours, and, being the practical experience of a local man, can be accepted by other settlers with greater assurance than the report of similar experiments.

"In the beginning of January, 1903, when the drought was pressing very heavily on the settlers in this district, Messrs. Kirby conceived the idea of trying to grow some artificial feed for their sheep, and with that intention picked out a block of 19 acres, which they enclosed, and around which they dug main service drains. The land was roughly scarified with a cultivator, with seeder attached, and Amber-cane seed, at the rate of 22 lb. per acre, was sown. Then another service drain was run down the centre of the paddock, making three drains about 5 chains apart. From these main drains a series of shallow gutters, 4 inches deep and 1 foot wide, were run 6 feet apart right across the paddock, causing a complete reticulation by gravitation. The seed came up splendidly, but when it was about 2 inches high a multitude

of galahs attacked it and riddled one-half of it to the extent that the owners had no hope of any crop from that particular portion. However, what was not destroyed grew and stooled out well, and, though there was not nearly as large a yield on it, there was still a very good crop. Kirby Brothers had about 1,600 choice ewes of about 1 year old (losing their lamb's teeth), consequently they were about the worst class for this experiment. They had been fed on scrub and scattered herbage until they were so emaciated that lots of them had to be carried in vehicles and on horseback to the growing crop. Eight weeks after the seed was sown the cane was 7 feet high, and on the 20th March the sheep were turned into the sorghum for about one hour the first day, and that time gradually lengthened each day following for one week, at the end of which time the sheep were allowed to remain on the sorghum the whole day during the whole time of feeding. Mr. Kirby fenced off about two acres of the sorghum with wire netting, and simply turned the 1,600 sheep on to it, and though they were in a dying condition, less than a dozen succumbed. The sheep soon got the knack of pulling the stalks down, for one would stand up against a stalk, passing one front leg around it, and press forward with its chest, while others seized the flower head and others ate the leaves. When all these were devoured, the bare stalks flew back into an upright position. When all the leaves were eaten, the stalks were attacked, generally about two feet from the ground, and were then eaten right down to the ground level. When all the cane was eaten in the 2-acre patch, the sheep were turned into a similar plot adjoining; as the fences were merely stakes with wire netting around them, shifting them was no trouble. The sheep were fed entirely on the Amber-cane for ten weeks, and at the end of that time the frost had come and arrested the second growth. As our readers will remember, good rains set in at that time, and natural herbage was so abundant that further feeding was unnecessary. After nine weeks' feeding, about 7 acres remained, and as there was good herbage from the rains that had fallen some few weeks before, the sheep were allowed the run of this remaining portion of 7 acres for the last week, making the tenth week. There was still a good deal standing when the sheep were removed, quite sufficient, Mr. Kirby believes, to have lasted some weeks longer.

"This experiment was entirely satisfactory, as the sheep gained in condition and general appearance, and would leap about on their way to the sorghum every morning from the paddock where they were put at night. It will be seen that 1,600 sheep on 19 acres gives an average of 84 sheep per acre, and they were fed entirely on the Amber-cane Sorghum, and had bore-water to drink. The sheep were absolutely starving when they were put on the sorghum, and had been existing on scrub previously. Their condition was so low that their owners were afraid to leave them on the sorghum for more than an hour each day at first. The cost of feeding was as follows:—Planting, £2; seed, £8 15s.; cost of irrigation channels, £3; man's wages (irrigating sorghum for six weeks at 35s. per week), £10 10s.; attendance on sheep for ten weeks at 32s. 6d. per week, £16 4s. Total, £40 10s. This works out at about £10 per 1,000 per month, or about the same cost as agistment.

"Messrs. Kirby Brothers have had no occasion to feed their sheep since then, but Mr. F. Kirby says that, in case of another drought, he would plant a paddock earlier, when he feels satisfied he could feed the same number of sheep on an equal area of ground for six months, or right up to the end of June, as after the frost the growth of the sorghum is stopped.

"As before mentioned, the crop was 14 miles from the bore, so the water was quite cool when used, and, as it served several holders before reaching Belara, it was practically surplus water.

"We certainly trust that these enterprising settlers may not have to artificially feed their sheep again, but it is gratifying to know that other bores besides that at Moree have proved suitable for irrigation purposes. Mr. Kirby is of opinion that the sheep thrive far better if allowed to pick their own feed than if hand-fed. He states that the sheep ate every scrap of the stalks, though some was rather coarser and harder than a person would think sheep could tackle."—*Moree Gwydir Examiner.*

From these actual results the following definite statements may be made:—

1. That an acre of our black-soil plains, if irrigated with bore-water, will support over eighty sheep for three months.
2. That the most economical method of feeding, if the feed is not chaffed, is by grazing the sheep on the crop.
3. Crop requires to be sown at different periods, say every month, commencing in October, continuing to January.
4. That *when the cost of feeding sheep* in a dry time (including renting country, droving, trucking, and shepherding, &c.) *exceeds* £10 *per* 1,000 *per month*, on any property where *there is suitable bore-water available, they can be more economically fed at home on irrigated crops.*

According to this, 100 acres of irrigated sorghum will feed 8,000 sheep for over three months, and on most properties, where there is already a bore, sufficient water could be spared to irrigate that area. In cases where the water cannot be spared in summer, crops of wheat or barley could be grown during the winter months, and in some places storage reservoirs could be filled during the winter, and the water gravitated to lower areas throughout the spring and summer months. The actual cost of production, of course, depends on the labour and implements available; in many cases seed has been sown broadcast on the virgin plain and merely covered with the cultivator. Whilst these makeshift methods are not to be recommended for general agriculture, they sometimes give satisfactory results for annual crops like wheat, sorghum, &c., under irrigation; but for a perennial crop like lucerne, deep ploughing, grading, and thorough preparation will be amply repaid by the extra production. As it is admitted that in this State there is only a limited amount of water available for irrigation, we must make the best of our artesian supplies, and it is to be hoped that these remarks may encourage its more extensive use for that purpose. The area cultivated need not be very large (only 1 *per cent.* of the average western holding under irrigation would be an absolute insurance against loss of stock in drought), and if the feed produced is not required immediately it can be easily conserved in the form of ensilage for an indefinite period. The Agricultural Department will forward full particulars and pamphlets of ensilage-making on application. In cases where *unsatisfactory results have been obtained* from bore-water, the settlers are also invited to communicate with the Department, who will advise as to the suitability of the water and methods of application, or perhaps send an officer to investigate in the field. At the present time the demand for artesian bores is chiefly to supply *water* for stock purposes, but when more

experience in irrigation is obtained, the bores will undoubtedly be considered as great factors in stock *food* production; for most pastoralists who have had any practical experience on the subject acknowledge that irrigation is of great benefit to the pastoral industry. The wool industry is the most important in the State, and its greater development and stability will be brought about more by irrigation than by any other means. The more extensive practice of irrigation will change the position of the agricultural and pastoral industry from an anxious and uncertain dependency upon the natural rainfall to a more regular and certain state, and by producing more feed, more stock, and, therefore, more *money*, will eventually lead to a larger and more prosperous population in the semi-arid districts.

Report of Experiments carried out at Fareham, Marra Creek, *via* Girilambone.

T. E. GRIGG, Fareham.

Perhaps a word or two will not be out of place as to my reasons for carrying out this work. I have held the opinion for some years that this part of the State is not unsuited to cultivation owing to natural conditions. One hears the cry so often that the Western Central Division is not fit for settlement. As one holding different views I thought I would show that we could produce anything in reason that a settler would want, if given the water. Unfortunately, those that have the artesian bores will not use them to develop this part, and those that would develop the country are kept from it, and, worse still, there are only a few of our settlers using the creek or river water for irrigation. I believe that if certain artificial conditions were removed, and the lands in this district made available, we could increase our population tenfold. If only from a grazing point of view, what better or healthier lands could you wish for than our salt-bush and myall plains? We have the soil and climate, and we could have the water (artesian) for the tapping, or by conservation. And as for any new settlers—they could not wish for a more healthy district for themselves and families. We can grow wheat, corn, oats, barley, fruit, and vegetables to compare with those grown in the best districts; in fact, few districts can ripen tomatoes every month in the year. I grew vegetables and tomatoes all through last year, besides carrying out the following experiments for pleasure. In wheats I grew eleven varieties, and I found Steinwedel to be the best grain under the conditions here; Bobs did well, so did Jade and Nutcut; Skinless barley did splendidly; and a variety of oats I obtained from America, called Texas Rust-resistant, did first class. I have tried Broom millet, and grown splendid samples; also Pearl, Hungarian, Japanese, and French, they do splendidly. Kaffir corn, Johnstone grass, and sorghum all make rapid growth. Lucerne

does well, and I would like to draw attention to one variety of ***Medicago media.*** It is a hardy lucerne from France. Mr. Peacock, Manager, Bathurst Experimental Farm, gave me a few seeds in 1901; it is the best drought-resister I have come across. It does not yield so heavily as the common sort, but if once established it is there for good, and should be given a trial by some of our settlers. Rhodes grass has done splendidly; it stands the heat well and is not cut down by the frost, and although it looks coarse, the stock are fond of it and will eat it at any time. Sweet potatoes gave great results, and should be grown in every garden. Peanuts grow to perfection; they should be a standby as a fodder plant, for they grow an abundance of green top, and my pigs are very fond of it. Cotton did well, and makes a pretty tree in any garden. Arrowroot grew well. The late frost, however, killed the pine-apples. In vegetables, pumpkins, squashes, marrows, potatoes, cabbage, peas, beans (six sorts), tomatoes, beets, radishes, cucumbers, turnips, swedes, rhubarb, cauliflowers, chocos, egg plants, onions, lettuce, cress, sweet corn, and herbs have all grown splendidly; and as for melons, they can be grown for seven months out of the twelve. I have tried eight varieties of corn, and Golden Beauty gave the best result. In edible scrubs the young Kurrajongs are doing well. I have also some Mesquite (*Prosopis juliflora*), two years old, said to be drought resisters; they have grown 3 feet high, but seem too tender for this climate. The Carob beans did not live through the summer. I tried striking Kurrajong cuttings last year, and I have succeeded so well that I intend putting more down this year.

Important Notice to Importers of Pigs from England.

The Minister for Mines and Agriculture has received from the Secretary to the National Pig Breeders' Association, Ruddington, Nottingham, England, under date 24th May, 1906, a copy of a resolution passed by the Council of the Association, as follows:—

> "That the Secretary informs the Minister of Agriculture in foreign countries that export certificates are issued by him, when demanded, for pigs sent abroad, and that such certificates, signed and stamped with the seal of the Association, constitute a guarantee that the animals so certified are pure-bred, and entered, or eligible for entry, in the Herd-book of the Association.

"My Council decided upon taking this step in consequence of the fact that a large number of pigs have been exported as Large Whites that were not pure-bred, and, therefore, not eligible for the Herd-book of this Association."

Tobacco.

By Messrs. GIRARD and ROUSSEAU.
From the *Journal d'Agriculture Pratique*.

Tobacco is characterised by the extreme rapidity of its growth. No other plant, grown on a large scale, can be compared to it in this respect. This dominant fact of its physiology should regulate all its cultivation. During the first month after the seedlings have been transplanted the growth is very slow, as the roots have not taken hold of the soil; in fact, the plant appears to be in a dormant state. During the next two months it acquires nine-tenths of its total weight, so that, although occupying the soil from 86 to 100 days, it has scarcely 60 days in which to develop fully. In this short time the plant has to obtain the major part of those nutritive elements necessary for the perfecting of its tissues.

We do not know of any other cultivated plant, with the exception of vegetables, which attains to such a large development in such a short time; nor one which requires such excessive nourishment. An important fact is, that it possesses no specially perfected root system or foliage. It certainly is not better organised than other plants to draw nourishment from the soil, yet it has larger requirements than most, and less time in which to supply them.

Soil.

What we have learned of its rapid growth and excessive requirements shows that, for tobacco more than for any other plant, a soil abundantly supplied with fertilising elements is necessary. The best are old rich soils, which have been under cultivation a long time, rich in manure, and specially assimilable elements, healthy and deep; permeable, and of medium consistency. It must be well worked in order to assist the rapid penetration of the roots. Very often it has to be ploughed three or four times, and deeply, if it is very heavy. Sometimes this work is neglected on account of the cost, and a green crop is merely ploughed in instead, before the tobacco is planted out. Then the ground is broken up in summer, and this followed by a light ploughing in the spring; but under these conditions the crop is small and unsatisfactory. A deep and frequent working of the soil is of great importance, and also, as to the accumulation and conservation of moisture.

Rotation.

Occasionally tobacco is cultivated continuously on the same soil for five, six, or even up to ten years; sometimes for only two, generally following a cereal or root crop. But the rules of rotation, which were formerly regarded

as the basis for all successful agriculture, have to-day lost some importance through the use of special fertilisers, which restore to the soil such elements as have been appropriated by the crops. Still we advise a fairly long interval between the crops; for, besides favouring the invasion of the *orobanche*, a too frequent repetition of the crop causes a sort of sickness of the soil. The continuous cultivation of tobacco on the same land when very richly manured, although providing the plant with an abundance of assimilable elements, exposes these latter to a considerable diminution; whereas, if a winter crop of cereals were to intervene, they would be partially conserved to the soil.

On certain poor soils where manure is scarce, it is customary to grow an intermediate green crop for ploughing in, between a cereal and a tobacco crop (such as radishes, rye, or vetches), but this practice cannot be recommended. It hinders the proper preparation of the soil, which cannot be deeply ploughed during the winter, and also retards the application of manure, and the transplanting of the seedlings. As a rule, it leaves an inferior and unsuitable soil, unless corrected by the use of chemical fertilisers.

Manures.

Farm manure is the principal and often exclusive fertiliser used. Chemical fertilisers may be added here and there, but are never used exclusively; and we have already called attention to the frequent ploughing in of green crops. Farm manure supplies to the soil a larger quantity of fertilising matter than is required by the crops, but heavy manuring is productive of large crops to a certain limit. When (as it sometimes does) the manure contains more than 6 to 14 cwt. of nitrogen per hectare ($2\frac{1}{2}$ acres), 3 to 10 cwt. of phosphoric acid, and 3 to 8 cwt. of potash, then there is an enormous excess, and a cultural as well as economical error. In the first place, if the potash and phosphoric acid are put into a soil sometimes already rich in these two elements, the nitrogen is carried away by the winter rains; secondly, it is an extravagance to use fresh manure (which is very costly) even for a very remunerative crop. On the other hand, sometimes the growers are too sparing with their manure, and the nutritive elements in it scarcely suffice to meet the requirements of the crop. Such districts produce the poorest tobacco, not only because of the scarcity of manure, but because the soils are often poor in themselves, and the practice of ploughing in green crops aggravates the evil. The time for manuring is of great importance, and if this takes place only shortly before the planting-out, the result will be an indifferent crop, for the following reasons:—The introduction, all at once, of a large quantity of manure mixed with straw, loosens the soil, and causes it to quickly dry.. The only remedy would be to roll it well with heavy rollers. A second and more serious disadvantage is, that by applying the manure too late, the elements have not time to decompose in the soil, and to undergo the series of transformations which prepares them for nourishment of the plant. On the contrary, a too early manuring—that is, before the winter—has the great disadvantage of causing loss of nitrogen. The best time is

towards the end of winter, after the heavy rains. As regards the practice of ploughing in green crops to supplement an insufficiency of farm manure, it is not to be recommended.

Chemical fertilisers.

It is well known that the tobacco-plant requires a large quantity of rapidly assimilable elements at its immediate disposal, and the chemical fertilisers are all prepared to satisfy this requirement. Their use in this culture gives the most remarkable results. The elements they contain being soluble the plant finds its food in readiness immediately after it is transplanted; therefore it develops more quickly than by the aid of farm manure.

According to experiments made in five fields, the addition of chemical fertilisers to the farm manure gave an increase of nearly £12 profit per hectare (2½ acres), and also produced a better quality of leaf; thus the extra outlay (£3 10s.) for chemical manure was very profitable.

But the best result of all was obtained by the sole use of chemical fertilisers, which gave an increased profit of £18 per hectare, as compared with farm manure. The cost of the chemical fertilisers was £6 8s. per hectare, consequently, the increased profit was about £12, besides economising the farm manure.

In the case of smoking tobacco, in which it is necessary to avoid an excess of nicotine, it may be asked if a too copious supply of nitrogenous fertilisers will not have an injurious effect. Our observations made on specimens grown under the most varied conditions enable us to say that, without fear of injuring the quality, the grower may and should use these manures, which give both size and weight to the leaves; but we have not been able, as yet, to decide what influence they have on the exterior qualities of tobacco: the fineness, silkiness, aroma, colour, and flavour, &c. As regards combustibility, we know that this is in proportion to the carbonate of potash; thus, if the potassic salt, without increasing the crop, causes the tobacco to burn better, it should be used. (The use of chloride of potassium should be absolutely prohibited in the cultivation of tobacco, as it decreases its combustibility.) In our experiments we have been surprised to find that neither richness of soil nor the quantity of potassic fertilisers have any marked effect on the percentage of potash in the leaves, which shows that the absorption of potash, and therefore the combustibility, is an attribute of the variety of plants. We greatly recommend hybridisation, which has proved so successful in other cultures, as it might enable us to dispense with the importation into France of unpopular foreign tobaccos.

After the two first operations the soil cannot be worked any more without damaging the leaves, the development of which prevents the growth of weeds. The planter has now to nip off the shoots which appear from top to bottom of the stem, and at the base of the leaves. This work is repeated several times, according to climatic circumstances and vigour of growth. The dry weight of these shoots is very variable, but averages about 7 cwt per hectare (2½ acres), or 8½ per cent. of the total dry crop. During their

formation, they appropriate about one-seventh of the amount of phosphoric acid and potash required for the whole of the crop. This percentage is very high, and shows the necessity of restricting their growth as much as possible. Small crops are generally the consequence of the neglect of this; therefore, the plant should be examined every day, and the shoots removed as soon as they appear.

Crop.

The plants arrive at maturity in about eighty-six days, in the open fields. The crop consists of stems, roots, and leaves, which must be examined separately if we would arrive at an exact knowledge of the physiology of the plant.

Stems.

These do not contain quite as much potash or nitrogen as the leaves, but their weight is very considerable. In a given quantity of dry crop, the stems represent about 18 per cent.—that is, 6 per cent. for smoking, and 12 per cent. for snuff-tobacco. About one-fifth each of the fertilising elements,—nitrogen, phosphoric acid, and potash—drawn from the soil by the whole crop, is thus to be found in the stems.

Roots.

The weight of the roots is higher still than that of the stems. It averages about 25 per cent. of the total dry crop, or equal to two-thirds of the weight of the leaves. The roots, however, contain a comparatively small quantity of fertilisers, and to increase the development of the plant every effort should be made to extend the root system. For tobacco, the organs of absorption should be as perfect as possible, not only because it has to absorb a large quantity, but also because this has to be done in a very short time.

Leaves.

These constitute the only useful part of the plant, and from these the profits are derived. It is the weight and quality of the leaves which regulate the price. The weight is very uncertain; it may vary from 12 to 18 cwt. to the acre. Taking the official records, we find 6 cwt. per acre the minimum, and 22½ cwt. the maximum for smoking tobacco. Tobacco is extremely sensitive to external influences, particularly dryness; and apart from these, the number of leaves on each plant is of importance, as our experiments show that the weight of the crop increases with the number of leaves allowed to each plant. Thus, if pruned down to six leaves, the crop will return, say, 16 cwt. per acre; with 8 leaves, about 18 cwt.; and with 10 leaves per plant, 21 cwt. per acre. It must be understood that the large leaves are not the most valuable; but it is easy to judge the right number of leaves suitable for each plant to carry, according to its vigour and the amount of fertilisers used.

Wheats and Frost

R. W. PEACOCK.
Bathurst Experimental Farm.

THE question of the damage by frosts to our wheat crops has not received the consideration it deserves. Frosts are responsible for more damage during certain seasons to the crops throughout the wheat belt than such diseases as Rust and Bunt.

In the year 1900 many thousands of acres of wheats were reduced in yields fully two-thirds by frosts following upon the mild weather conditions prior to the beginning of July. *Vide* my report, page 987, Vol. XI, *Agricultural Gazette.*

At this farm during 1904, frosts considerably damaged the wheat crops. In 1905 they were damaged in a lesser degree.

In the Northern districts, around Werris Creek, considerable damage resulted from frosts in 1904. Mr. Robt. Scobie, junr., writing respecting his wheat crop, states: "Fully 400 acres of our wheat died right off, and four weeks ago could have been burnt"; the subsequent yield of this crop was about six (6) bushels per acre."

In a great many instances the trouble was attributed to a disease; many considering that it may be due to a disease known as "Take all." It is highly probable that, in many cases, the effects of frosts have been confounded with "Take all."

From extensive observations in the field, and of affected samples forwarded from other districts, and also experiments carried out at this farm, I am convinced that the damage coming under my notice is attributable to frosts. The serious effects are first apparent upon the flag of the early sown crops about mid-winter. The flag turning brown in quantity gives the field a parched appearance, as though affected by drought. Upon investigation it will be found that the first node or knot of the stem above the ground is brown and discoloured, and that the stem between the first and second nodes is quite discoloured inside. The cuticle of the node is burst, there being a complete rupture of the tissues at this part of the stem, the stems in many instances being completely killed, and in others only partially. In the severe cases the whole of the plant above the affected nodes die; where the rupture of tissues is not so severe, the portion of the stem above the node may be only partially affected, and eventually produce a head or part of a head of wheat. Notwithstanding the plant's ability to produce a head of wheat, the injury to the stem may be so great that towards harvest a heavy wind may break the straw at the node where it was weakened, and the head be placed out of the reach of harvesting machinery or fail to mature, and wilt in the form of hay. In thinly sown wheat I have seen considerable loss from this cause. In the event of the stems being killed completely above the nodes, the root system being vigorous sends out fresh shoots, resulting in

a second growth, which, if the frosting has been severe, may represent the whole of the crop harvested. When only partial killing of the plant above ground takes place, the second growth represents only a portion of the crop, which may ripen considerably later than the uninjured original growth. Such a case allows of a lot of immature heads being harvested with the matured, resulting in considerable loss. Also many of the heads are affected by some of their spikelets being completely killed whilst very young, and several months before the ears appear. Spike-

Bobs Wheat injured by frost whilst undeveloped.

lets may be missing from the tip, the middle, or base of the ear, as is apparent by the plate. If the conditions are very favourable, after the killing of the original above ground growth, a very creditable crop from the second growth

sent up by the vigorous root system may be harvested. I have known over 20 bushels per acre to be harvested after the original growth had been completely destroyed. When the conditions are not favourable, the second growth may not exceed 4 bushels per acre. It will thus be seen that the losses may be very considerable, and to guard against them a better knowledge of the action of frosts is desirable. Throughout the wheat belt proper of the inland

Bobs Wheat injured by frost whilst undeveloped.

Bobs Wheat uninjured by frost.

districts, the conditions are extremely favourable for severe frosts throughout the winter, they being calm, clear nights, and comparatively dry atmosphere.

The dry atmosphere also allows of a greater amount of the sun's heat being absorbed by crops and soil throughout the day, which is again for the same reason radiated very quickly at night. A wide range of temperatures is thus brought about which, under certain conditions, is disastrous to some

wheat crops. These undesirable ranges of temperature are greater upon certain soils and positions. Aspect has a considerable influence in this respect. A north-easterly aspect obtains the greatest amount of solar heat, thus inducing a quicker growth in the winter time, which is more susceptible to frosting. In such positions susceptible crops are invariably frosted during severe winters. Upon the low-lying fields frosts are the heaviest, due to the cold air being heavier than the warm; the air after being chilled upon the higher levels sinks to the valleys, and the warmer air of the valleys rises to the higher levels. In such positions the losses from frosting are the greatest.

During some seasons there are portions of the winter very favourable to growth, and the tissues produced are very susceptible to injury when the seasonable frosts occur. Under such conditions a very considerable range of temperatures is experienced. The cells of the plant tissues are also surcharged with sap, and in places, such as the nodes or knots where the cell walls offer resistance and are not so elastic as younger tissue, a complete rupture of the cells results, bringing about the death of that portion of the plant above the nodes. Such rupture is due to the cell sap upon being frozen expanding beyond the confines of the cell. When the growth is rapid, due to the most desirable quantities of moisture, heat, &c., the cell sap contains a larger proportion of water, and may freeze more readily than if charged with a greater proportion of plant-food.

It will thus be seen that there may be several predisposing influences in favour of frosting, the principal being an early growth which had run up to stems with knots of sufficient resistance to allow of rupture. Also a very favourable period allowing of forced growth prior to severe ground frosts. The damage from this cause mostly occurs in the winter time, and to what is generally termed "winter-proud crops." Crops which are not advanced, and composed principally of procumbent leaves and about one foot in height, may not be affected at all by frosts; whereas forward crops with well-defined stems, and from 18 inches to 2 feet 6 inches high, are completely killed in the same paddock under identical weather conditions.

During winters of what may be termed seasonable weather—that is, when frosts are continually recurring without any very great break of mild conditions favourable to rapid growth—the tissues of the wheat-plants are able to withstand greater degrees of cold without injury.

Some varieties of wheat are more susceptible than others to frosting The habits of growth, which may be termed predisposing characteristics, are, tendency to run up quickly to stem during the winter, as opposed to the excessive stooling or procumbent habit of some varieties, and erect narrow leaves as opposed to the spreading broad leaves of others. The Fife wheats, which comprise the Manitoban varieties, and those of the White Lammas and similar groups, have procumbent leaves and stooling habit, and are thus enabled to withstand extremes of temperatures during severe winters. Some of the new varieties are not susceptible to frosting, whereas others have the above-mentioned predisposing characteristics. As regards the predisposition of varieties having erect narrow leaves, such a habit allows of a quicker

radiation of heat from the soil to the atmosphere upon frosty nights than those having procumbent broad leaves. The latter class of leaves also protects and traps the moisture given off from the soil, thus providing a protective envelope of moisture around the susceptible tissues. These predispositions only apply to the phase of frosting which I have outlined above. There are other phases, such as when the tips of the leaves only are affected, due to the chilling of the roots, which prevents the flow of sap to the tips of the leaves as quickly as the early morning sun demands the transpiring moisture. What is termed "burning of the tips" is the result. Such is not a permanent injury and may not interfere in any way with the yields of grain. Also a too-forward crop may be wholly or partially destroyed, from a grain point of view, by the ears at the time of blossoming being cut by an unseasonable frost. Such is usually preventible and calculated for by the farmers.

When a crop is damaged at the nodes of the stems during the winter, ears may appear with many spikelets missing, as shown in the illustration. Such ears were injured by the winter frosts whilst they were very small and undeveloped. It is not difficult to see the embryo ear of wheat in all its lineaments when the plant is 6 inches high if care is taken in the dissecting of the plant. This fact is important and should be borne in mind by the farmer, for when a crop is frosted severely or eaten down closely by stock all the original ears of wheat are destroyed, and the plant has to throw out adventitious shoots which, if the season is favourable, may produce a very satisfactory crop. To guard against this class of frosting, all varieties predisposed to frosting should be sown somewhat later than others. If it is desirable to sow them early they should be fed by sheep throughout the winter, care being taken not to feed off too late in the spring, as such may interfere considerably with the yields, especially if the spring turned dry.

Winter-proud wheats are always susceptible to frosting; such should be fed off by stock, as it is not wise to take the risk. They are also liable to lodge in the spring on account of the sunlight not being able to strengthen the tissues at the base of the stems.

Owing to the serious damage attributable to frosts, it behoves the farmers to study more closely the varieties they grow. Of the new wheats, Bobs and John Brown are two which at this farm have proved susceptible to this form of frosting. King's Early and Steinwedel were also affected, the latter not so badly as those previously mentioned.

In the production of wheats for Australian conditions, the effects of frosts cannot be ignored, and makes the task of producing suitable varieties much more difficult. For instance, the erect and narrow leaves as regards rust resistance are valuable, but are characteristics which predispose to frosting.

The lowest temperatures registered at this farm by a thermometer placed 4 feet 9 inches from ground at the orchard, the nearest recording station to the wheat areas, were 13 degrees of frost in 1904, and 9 degrees of frost in 1905. It is only reasonable to suppose that the temperatures went several degrees lower on the surface of the wheat paddocks, as the majority of these were on lower levels.

Weeds of New South Wales.

PURPLE-TOP OR WILD VERBENA (*Verbena bonariensis*, Linn.).

J. H. MAIDEN,
Government Botanist and Director of the Botanic Gardens, Sydney.

Botanical Name.—Verbena (already explained, *Gazette* for July, 1905); *bonariensis*, Latinised adjectival form of Buenos Aires, the capital of the Argentine Republic, South America, the home of this particular plant.

Botanical Description.—Genus, *Verbena* (already explained, *Gazette*, July, 1905). Note.—*V. venosa* and *V. bonariensis* both belong to the Section Pachystachyæ, with abbreviated flower-spikes.

Species.—Bonariensis, Linn.

An erect, coarse, rigid herb of 2 to 4 feet, the stems scarcely branched, acutely four-angled and roughly hispid, especially on the angles.

Leaves.—Sessile, lanceolate, or the lower ones ovate-lanceolate, 1½ to nearly 3 in. long, coarsely toothed, hirsute, the upper ones distant, small, and narrow.

Flowers.—In rather close spikes of ½ to ¾ in., which are usually clustered at the end of the branches of a rigid corymbose, trichotomous panicle, and generally assume a bluish purple hue.

Bracts.—Acute, ciliate, hirsute, 1 to 1½ lines long.

Calyx.—Shorter than the bract.

Corolla-tube.—Shortly exceeding the calyx, the lobes broad and spreading. (B.Fl., v. 36).

In contrast to the other Verbena (*V. venosa*, figured in the *Gazette* for July, 1905), the present species is far less showy. The short and crowded flower-spike of *V. bonariensis* is by no means so conspicuous as that of the dwarfer plant *V. venosa*.

Vernacular Names.—"Wild Verbena or Vervain," "Purple-Top or Weed" are the only names under which I have heard it referred to.

Fodder and other Uses.—So far as I am aware, stock never touch it except by accident, when eating the top off prunes it. It bears a large quantity of seed and spreads rapidly in waste places, and even encroaches on pasture land. The most that is good that can be said of such plants as this and its close relation, the Lantana, is that, while it has possession of an area, such land is rested, one cannot say fallowed. There is nothing poisonous about the plant. At the same time its room is better than its company, and it ought always to be hand pulled when it makes its appearance in a fresh place.

Where found.—The species is common in waste places and pastures in extra-tropical South America, and has spread as a weed of cultivation over South Africa, the Mauritius, and some other countries, and is evidently introduced only into Australia. (B.Fl., v. 37).

It is a very old Australian colonist, and now it is found practically over the settled parts of Australia.

EXPLANATION OF PLATE.

1. General view of plant, much reduced.
2. Showing inflorescence, natural size.
3. Showing the angular (quadrangular) stem and the venation of a pair of the opposite leaves. Natural size.

A PURPLE TOP OR WILD VERBENA

Report from the Agent-General.

New South Wales Apples at the Royal Horticultural Show, England.

A shipment of twenty-five cases of apples grown at the Bathurst Experimental Farm, and forwarded by the Department of Agriculture per R.M.S. "Orontes," for exhibition at the Royal Horticultural Show, reached London on the 10th May last. As suitable cold storage space could not be obtained in Sydney at the time of shipment, arrangements were made for their carriage to Hobart as ordinary cargo and for transferring them into cold storage, which there became available to Tasmanian apples.

The Agent-General now reports, under date the 25th May, as follows:—

Every effort is being made to keep the best of the apples for the Show, but as will be seen from Mr. Clarke's report, all the apples did not arrive in prime condition. Those which reached here sound were certainly very fine specimens, and served to demonstrate the fruit-growing possibilities of the State. I may add that the efforts of your Department to assist us in advertising effectively the resources of New South Wales are much appreciated.

The price obtained for the repacked and partially-damaged apples, which had to be sold as the only alternative to total loss, was very low; but this cannot be regarded as affording any indication of the value of such fruit in prime condition and placed on the market in the ordinary way. Buyers are very chary of repacked and bruised fruit, so that it had to be sold at exceptionally low rates.

Report on Apples forwarded for Horticultural Show.

"The twenty-five cases of apples forwarded for exhibition at the Royal Horticultural Society's Show on 6th and 7th June, were received, *ex* 'Orontes,' on 10th May.

"In order to ascertain the condition of the fruit and determine the best steps to take to keep it in good condition until the exhibition, six cases were brought direct from the dock to our Cannon-street premises, and Messrs. Keeling and Hunt, a leading firm of fruit merchants, were asked to make a survey and report. It was found, upon external inspection, that juice was dripping from three of the six cases, and when opened up it was seen that although a great many of the very fine specimens of apples had carried well, a considerable proportion, especially of the larger fruits of Jonathan and Five Crown varieties, had become quite soft.

"Messrs. Keeling and Hunt expressed the opinion that there was no possible chance of keeping the twenty-five cases until the 6th June. They agreed with my proposal to open up each case, select a few of the best specimens, throw away those too far gone, and sell the rest as repacked

fruit. It would have been better to have had the repacking carried out at the premises of Messrs. Keeling and Hunt, but they said that such a procedure was impossible—they could not spare the space, and repacking was a practice they had made it a rule never to resort to. I therefore went as carefully as possible through the whole lot, using fresh wrapping-paper, and removing the Bathurst Farm seal from the lining papers.

"The first-grade Jonathans, of which there were seven cases, had certainly been magnificent specimens of highly-coloured fruits, but too large for a trade in which the fruit is sold by the pound. Of the seven cases, apples equal to two cases in bulk were absolutely unfit for any purpose, many being quite decayed. One case, however, contained over 80 per cent. of excellent fruit, and the fruits selected from this have been put away on shelves for the Exhibition. The remainder were repacked for sale.

"The second-grade Jonathans opened up fairly well, but, with the exception of about twenty specimens, they were too soft to be kept with any degree of safety, and were also repacked for sale.

"Of the four cases of first-grade 'New Yorks,' the majority were fairly sound, but nearly every fruit, with the exception of about six dozen, was badly mottled. These also are too large to be favourably regarded in the London trade. Three cases were repacked for sale. The second-grade 'New Yorks' carried well. The fruit is of a very acceptable size, and there appears to be every prospect of keeping at least half a case in good condition until next month.

"The first-grade Five Crowns had suffered very much in the same way as the large Jonathans. At least a fifth were rotten, and of the remainder there were few that had not some signs of incipient decay. However, by dint of careful selection, several dozen excellent specimens have been put aside on shelves, and will probably be available for the Show.

"The second-grade Five Crown Pippins appeared to have stood the voyage far better than any of the other apples in the shipment. Two cases did not contain a blemished fruit, one case had evidently been roughly handled and was ullaged, and the fourth contained 75 per cent. of sound fruit. It is expected that a good display will be possible with these second-grade Five Crowns. Many of them are now beautifully coloured, and they are almost perfect as regards size from the apple salesman's point of view. Thus, of the total of twenty-five cases, fifteen have been repacked and sold at 7s. a case, five have been reserved for the Show, and five have been thrown away.

"It is very unfortunate that these apples did not have the same chance of sound delivery as the Tasmanian and other apples carried in secured space do. From time to time I have had the opportunity of seeing many thousands of cases and barrels of apples from all countries sold at Covent Garden, the Monument, at Liverpool, and Bristol, but the method of packing with a sealed wrapper adopted by our Department of Agriculture is certainly far in advance of every other system, and would be much

appreciated here, where as many as several thousand packages are sold on a single case or barrel opened as sample.

"In forwarding any large number of cases for sale here, the packing, as in the 'Orontes' shipment, would be all that could be desired, but it appears to be important not to send apples of more than about 2½ inches in diameter. At the time of the year when our apples could be landed on a market that is but scantily supplied with long-stored American and Canadian apples, the retail price advances to 5d. to 8d per lb., and apples which go about two to the pound are not readily sold. It would also be well to avoid the inclusion of varieties that develop unsightly blotches or bitter-pit, as in the case of the New Yorks.

"Every effort will be made to display the apples effectively at the Royal Horticultural Society's Exhibition, but I am afraid that it will have very little chance in competition with fruit forwarded in special packages, and landed here within a few days of the Show."

Australian Fruit in Germany.

The Minister for Mines and Agriculture has received the following report from Mr. Coghlan, the Agent-General in London:—

I have the honor to forward herewith six copies of the auction catalogues of the last sale of Australian apples held by Lohmann & Co., Bremen. In their letter to me they report as follows:—

"We draw your attention especially to the West Australian fruit, which was splendidly packed and in first-class order. Although only weighing 15–18 kilos (one lot of 20 kilos) as against 20–22 kilos South Australian and Victorian fruit, it fetched as much as 19s. to 20s. per case, which would mean on a usual Australian case 25s. per case. This is the class of fruit we require for the German markets.

"For your guidance we may mention that, excepting lots No. 62–87, the rest of the fruit was consigned by our Australian firm to this market.

"We have formed the Fruchthandel Gesellschaft here (Fruit Company, Limited) as a broker firm three years ago, with the view of increasing the sale of foreign fruit, together with other firms here dealing in Spanish, Italian, and American fruit. Our Australian firm represents this company solely for Australia, and we are willing to advance freight, insurance, &c., on any consignments in Australia.

"With 60 million inhabitants in Germany and another 50–60 million in the adjacent countries like Austria, Russia, Denmark, Sweden, &c., the markets here are practically unlimited if properly taken care of, and will gradually prove, same as they do now already in wool, an important factor in the Australian export trade.

"If you wish any further information, we will be very pleased to give you same, and may mention that the next sale takes place here next week."

The Agent-General for New South Wales has forwarded to the Minister for Mines and Agriculture catalogues of the last fruit sales at Bremen, from which the following is quoted.

"Sold by auction, Wednesday, 9th May, 1906, at the sale-room, Grosse Waagestrase 4 :—

2,881 cases Australian apples.
334 „ pears.

South Australian apples, *ex* s.s. "Mooltan."

Cleopatra, from 12 marks to 16 marks.
Dunn's Seedling, from 11·75 marks to 16 marks.
Rome Beauty, 14 marks.
Jonathan, from 10 marks to 13 marks.
Strawberry Pippin, 9·75 marks.
Nick-a-Jacks, 11·75 marks.
Reinette du Canada, 8 marks.
Ben Davis, 13·75 marks.
Munroe's Favourite, 16·75 marks.

Tasmanian apples, *ex* "Mooltan."

S.T.P., 8 marks.
N.Y.P., 8 marks.
F.C., 10·50 marks.
S.P.M., 9·50 marks.
R.P., 10·50 marks.
A.P.M., 5 marks.
J., 10·50 marks.
C.E., 9·75 marks.

Victorian apples, *ex* "Telamon."

Jonathan, from 12 marks to 14·25 marks.
Munroe's Favourite, from 10 marks to 16·50 marks.
Rymer, from 8·25 marks to 12·50 marks.
Reinette du Canada, from 8·50 marks to 10 marks.
Alfriston, 11 marks.
Bismark, not landed.
Ben Davis, 13 marks.
Spitzenberg, 12·75 marks.
Emperor Alexander, not landed.
Cleopatra, from 10 marks to 13·75 marks.
Rome Beauty, 11 marks.
Sturmer Pippin, 6 marks.

"A large proportion of the "Telamon's" cargo had not been discharged at time of sale.

Pears, *ex* "Telamon."

These did not open up well, a large number of cases were wet, many being quite rotten and worthless. The prices ranged from 1m. for almost worthless fruit to 13m. for sound fruit. The fact that some fruit carried in fair condition indicates that if the right conditions prevail the carrying of pears to the Continental markets is quite feasible.

The Agent-General for New South Wales has received from Messrs. Lohmann & Co., Bremen, the following communication, *re* opening for Australian fruit in Germany : --

"We sold a lot of 125 cases of New South Wales apples, *ex* s.s. "Solingen," at a price of—

Five Crowns, special selected	16 marks.
„ extra choice	13 „
„ choice	11 „

"Unfortunately, the Five Crowns are not at all liked, and it was only the prime condition and the size of the fruit which made these prices, in want of other suitable large quantities this season. We would strongly urge your Agricultural Department to advise all fruit-growers to follow the example of the United States of America, and grow as few as possible different varieties. The sorts most liked are Cleopatras, Jonathans, and Dunn's Seedlings. These always command good prices.

"We will be pleased to send you our catalogues of larger sales, as the smaller form little criterion. At the large ones buyers are here from Berlin, Frankfort, Hanover, Cologne, Hamburg, South Germany, and even Russian buyers. Therefore, for good sorts there is no limit, but the inferior are difficult to move.

Note.—A mark is equal in value to one shilling.

Rabbits and their Destruction.

W. G. DOWLING,
Stock Inspector, Forbes.

THIS topic is legion, and has been discussed by land-owners almost as frequently as a drought; but though I have read most of the discussions, a large percentage of them present themselves to me as trying to get over the "hard work" part of it, and some scheme or other is always a-foot to make the rabbit automatic in his own destruction. Success will, I am sure, never crown any such efforts.

Anything that creates a vested interest in "bunny" must be tabooed at every point from a land-owner's view. No scalp money; no trapping for market; but the whole business must be looked upon from the beginning as an unprofitable curse, to be either mitigated to its lowest limit or got entirely rid of. The question is how to do it, in either case.

Well, my opinion gained over a life-time is—Hard and persistent effort in the first place, coupled with good judgment. For instance, it won't pay to spend 10s. per acre on land only worth 5s., but it will pay to spend 4s., because the land properly treated will recoup itself. There is not a very great deal of country on which something cannot be done of an effective nature, because land that is so rough or barren that it will not pay to treat is not rabbit country, and they will not increase in the same ratio as on good land. Keep them off land that will pay to keep them off, and the other land will keep them off itself. In a very large degree rabbits know how and where to live the same as any other of God's creatures, and a little study of their habits will never be lost.

On land to be dealt with the first thing to do is not to allow any house for him to live in, and to keep him from making frequent calls, net well, and where netting is contemplated, the best thing to do is to enclose as few as possible: it is bad management to net rabbits in, when netting fencing is done; net them out. Before any ring-fence is *entirely* closed the *haunt destruction* should be in full operation, and so worked as to drive the rabbits in a force to the point left open, and as soon as that point is reached the ring-fence should be completed. It drives a large quantity on to the man not netted at that point, but he can do likewise, so it is as fair for one as the other; and let me say right here that no netting-fence is complete unless pit-trapped, or yard traps put on at intervals. In the season when rabbits travel about for mating purposes, they run the fences and nearly all get caught, and when caught should be killed whether buck or doe. "A rabbit in hand is worth a good many hundreds in the bush." I have seen men have to look more than once to see what sex it belonged to. If you have such a thing as a

hundred to take out of a trap in a morning it won't pay to spend time "sexing" them, and it is not always possible to get good intelligent men for the purpose. Now as to the land to enclose so as to cope with them. This greatly depends upon the nature of the country; the smaller the better. Anything much over 7,000 acres in one block is not desirable; it costs too much to keep them under, and extermination is out of the question, except on farming areas of 600 acres or so. It won't pay to spend more than from 2d. to 3d. per acre, year in and year out, on ordinary grazing land after the initiatory work has been done, such as fencing and haunt-destruction. Grouping is objectionable; it is very hard to get all owners of one mind. What might be considered satisfactory work by one would not be so in the eyes of another, and in this district those who have grouped are contemplating isolation for the reasons given.

Cutting off the water supply by netting tanks and watering-places during summer months can be pretty well universally applied. The manner of doing this is as follows:—The tank or dam, and even creeks and rivers can be successfully trapped, only in the latter, the plan adopted is different. In the first mentioned the tank or dam is left open for stock during the day and closed at sundown, the rabbits enter through funnels smaller at one end so that they cannot return. To keep the watering places clean, men are allowed the right to skin, so long as they keep the place clear of dead carcasses; but it has been learned that, like everything else, "rogues" got into the game and some of those trapped always managed to escape, so that the plan of closing up entirely the tanks and dams is now adopted, and placing poisoned water in troughs made out of mud (rabbits take to water better if made on the batter than if made of wood), and it should always be put in sight of the original water. This acts as a decoy. This plan gives better results, because the skinner is saved the discretion of killing. If arsenic is used to poison the water it must be prepared according to the following formula, so as to avoid putting soda in, which makes it bitter:—Put 1 lb. of arsenic in 2 or 3 gallons of water, and stir continuously from then until 20 minutes after coming to a boil. Then add water to make up to 5 gallons. This will do for 50 gallons of water. For catching them on creeks or rivers, long wings of netting are run along the banks until their chief watering-place is reached; then poisoned water is put in mud troughs in sight of the stream. This method proved very effective in places along the Lachlan last summer, and in many places along creeks.

The outcry about Crown lands is, in many cases, slightly exaggerated. Stony hills close to grass land are a nuisance, but in very many cases these could be netted off. I have only written this to apply to the district I know so well, viz., Forbes. Other districts may be different, but a good deal of what I have said can be usefully applied all over the State.

A New Potato (*Solanum Commersoni.*)

From *The Journal d'Agriculture Pratique, &c.*

For the last three years the agricultural and scientific worlds have been interested in the experiments carried on at Verrières (Vienna), with the object of converting the *Solanum Commersoni* into an eatable potato. The *S. Commersoni* was originally a wild plant from South America, where Commersoni discovered it in 1767, growing on the wet banks of the Mercedes, near Monte Video. Its description, as furnished by Dunal, and more recently by M. Heckel, resembles in a remarkable manner that given by Herriot in 1584, of a plant brought by him from Virginia, which was believed to have been the origin of the potatoes acclimatised in England. In 1896, M. Heckel was apprised by M. de St. Quentin of the curious mutability of a wild plant in Uruguay: a tuber originally from the banks of the Mercedes. Having been convinced for a long time that our European potatoes were the offspring of the *S. Commersoni*, M. Heckel obtained some specimens of the plant, which were planted in the Botanic Gardens at Marseilles in 1901, for observation. These specimens were small and meagre; however, following the advice given for their culture, they were placed in soil very moist and rich. All of them grew well, though with rather thin, lanky stalks, having leaves slightly rounded, and lilac-perfumed flowers.

One plant was noticed as having stronger and thicker stalks than the others. Soon the ground at the root of this plant swelled out and broke, and violet-coloured tubers made their appearance, not very lenticular, perfumed, and of a slightly bitter flavour. The other plants remained precisely of the same type as *S. Commersoni*.

After careful replanting in 1902, three plants bore a great resemblance to the European potato; and in 1903, the results were so satisfactory, including, as they did, a fabulous crop of 103 tons to the hectare (2½ acres), with an absolute immunity from the potato disease (*Phytophtora infestans*) that the matter was brought under the notice of the National Agricultural Society of France, and new varieties are becoming more numerous every year. At Verrières, I saw huge baskets filled with these tubers, with a different kind in each basket; all, however, being distinguished by some characteristic of their own, principally by the colour of the flesh, white, yellow, or streaked with rose.

The appearance of the extensive plantations at Verrières, where M Labergerie cultivates his variations of the *S. Commersoni*, each being carefully labelled, would astonish anyone accustomed to ordinary potato plantations.

The exuberant vegetation, the very different aspect of one row from another, and even of one plant from the adjoining one, the very frequent presence, the size and abundance of the aerial tubers growing on the stems, combine to form a confusing spectacle.

Progressive Evolution.

Among the tubers dug up at different times, from a previously white variety, were found some yellow ones very irregularly spotted with violet; some with the eyes only coloured; while others were marked with large patches of colour spread over the surface, or fixed at the extremities. A plant precisely similar bore at the same time tubers all yellow, others all violet, with intermediaries more or less spotted. Other plants bore tubers of uniform colour, but all different, as for instance, yellow, rose, and violet. These transformations affect the violet variety rather than the rose, the series generally terminating in all violet. We may mention in passing that the violet and yellow portions of the one tuber having been divided and planted separately, produced, from the first, plants bearing violet tubers; from the second, plants having yellow tubers spotted with violet.

Variations of shape very often accompany these variations of colour. The tubers are sometimes elongated, sometimes round, with eyes more or less sunken. The stolons are generally short, and not numerous. At the end of some would be found sometimes a solitary tuber, sometimes a string, or a cluster. The stems in some cases were more than two yards long, while the yield from one plant would often exceed 5 lb.

Violet variety.

This we may consider as being definitely fixed in 1901. On the estate of Fontleasmes it is cultivated on sloping ground, with a medium soil, and very unequal as regards moisture. This latter circumstance enables us to estimate in what degree the dampness of the soil affects the crop. Unfortunately we have not been able to extend the comparison to ordinary potatoes growing under the same conditions. Plants about half a yard apart gave nearly 25 tons per hectare (2½ acres). In damp soil 32½ tons per hectare; and in very wet soil, near to a running brook, 39½ tons per hectare. The space between these plants is too great. By decreasing the distance between the rows, the yield was considerably augmented. Experiments have shown that a second tillage has no effect whatever on them.

Humidity is an essential condition to abundant crops in this variety. Five plants, which were constantly watered by a running brooklet, produced 22½ lb. of tubers. Another gave 5½ lb.; one articulated tuber weighing 2¼ lb.

In an old vine plantation, where recently vegetables have been grown under irrigation and manured with farm-yard manure, the vegetation of this plant was something extraordinary. The stems attained a height of from six to nine feet. The aptitude of the violet variety to produce aerial tubers is a remarkable characteristic which appears but seldom in the *S. tuberosum* On some plants grown from seed weighing a few grammes only, abundant crops of aerial tubers were obtained, but to the detriment of the underground crop. For instance, take No. 1 which gave·

Of aerial tubers, 3 lb. 5 oz.; underground tubers, 3 lb. 12 oz. Total, 6 lb. 12 oz
No. 2 aerial tubers, 3 lb. 8 oz.; underground tubers, 9 lb. 8 oz. Total, 13 lb.
No. 3 aerial tubers, 4 lb. 12 oz.; underground tubers, 6 lb. 10 oz. Total, 11 lb. 6 oz.
No. 3 bore two aerial tubers weighing 1 lb. each.

We believe that even in dry and unfertile soil very large aerial crops may be obtained from the violet variety of the *S. Commersoni*. These tubers appear at all heights on the stems, which are often 2½ yards long.

I have seen them growing on a mass of tangled stalks, 3 feet above ground on the stems, and on stalks propped up, much higher from the ground. This peculiarity added to the grouping in an articulated mass of the underground tubers constitutes a remarkable difference between the violet *S. Commersoni* and every known species of *S. tuberosum*.

The plant presents other peculiar characteristics. The constant protuberance of the underground tubers, and their very variable and often articulated forms, even in a very dry soil.

The flavour, absolutely correct, with neither bitterness nor after-taste, reminds one of a potato of good quality; but it has a slight perfume, and two curious peculiarities—no bitterness in the green parts, and a taste without any soapy flavour in the cold tuber.

Some of the *S. Commersoni* type, which had become highly improved, on being taken out of very rich soil and planted in poor soil rapidly deteriorated, and returned to their primitive condition; while, on the contrary, the richer the soil the more the improvements were accentuated, far surpassing the ordinary potato in both flavour and production. The resistance to frost is maintained as far as 2 degrees C. below zero for the stems, and to 4 degrees C. below zero for the tubers. Some lots have withstood the hardest frosts, and we hope to see produced at Verrières a selection still more superior in this respect. The violet variety preserves an absolute immunity against the attacks of the *Phytophtora*, even when planted in the midst of diseased potatoes. M. Delacroix, Director of the Station of Vegetable Pathology, has tried several times to infect the plant, but without success. The richness in fecula appears to be increasing. It has passed from 11 per cent. to 14, then to 15, next to 16 and 17 per cent., and even more in certain lots. In this respect the violet *S. Commersoni* is equal or superior to the varieties of our *S. tuberosum*; and wherever it has been placed in competition with the latter, even in medium and dry soils, the crop has proved notably superior in quantity.

As an interesting comparison, we will give the returns from plants grown in contiguous lines between the violet *Commersoni* and different varieties of potato:—

Violet	2½ lb. per plant.
Blue Giant	1 lb. 2 oz. per plant.
Richter's Imp.	1¾ lb. ,,
Early Rose	13 oz. ,,

From the above it will be seen that the work of M. Heckel and the experiments at Verrières have been successful in giving to agriculture new plants which promise extremely interesting results, both as a food for man, for the fattening of animals, and for manufacturing purposes.

Farmers' Experiments.

GEO. L. SUTTON,
Cowra Experiment Farm.

Great credit is due to those farmers who have recognised that any advance which is to be made in their practice, must come as the result of experiment, and who, believing this, have devoted time and money to supplementing the work of our experiment farms by conducting experiments, the object of which was the improvement of their own and their neighbours' methods. Unfortunately their efforts have not always been attended with the success they

Planting an Experiment at Sproule's Lagoon, Temora.

deserved, for it cannot be gainsaid that the results have in many cases been of questionable value. This has been due, not to lack of interest, nor to the absence of care and attention bestowed on the experiment, but to want of knowledge and training in this particular class of work on the part of the experimenter. A recent writer on this subject leaves no room for doubt about this, when he says :—" . . . . . . Many experiments which farmers attempt, however, are either valueless or actually misleading because of failure to observe some of the essential conditions of successful experimentation; for, investigation in agriculture by experiment is a business by itself, entirely distinct from ordinary farming, and many a good farmer will overlook points of vital importance to the success of an experiment until his attention is called to them."*

* "Essentials of Successful Field Experimentation," by C. E. Thorne, M.S.A., Director, Ohio Experiment Station, U.S.A.

The decision of our Minister, the Hon. S. W. Moore, to assist those societies who, with the co-operation of the officers of the Department, undertake to carry out this important work in a systematic way will give that stimulus to it which means progress. The assistance of the Department should supply the feature which in the past has been absent, and the absence of which has largely contributed to the failure of the experiments carried out.

It is contended by some that it is not the province of the farmer to conduct experiments, but that such work should be left entirely to the Experiment Farm. At first sight this may appear a reasonable contention, but I feel sure a little reflection will convince most of its fallacy. Everyone will agree that all classes of experiments are not suitable for the farmer to carry out, for the farmer is a commercial man engaged in a business for the profit there is in that business, therefore, any experiment conducted by him, except in

Planting a Farmers' Experiment, Reefton.

a public-spirited way, must be of such a character that the results are likely to be of **direct** profit to the experimenter, otherwise the experiment is likely to be neglected the first time it interferes with the least of his other multitudinous duties. Such experiments, too, must be planned with a due regard to the conditions under which he farms, and must be adapted to the implements and machines he possesses.

There is, however, a class of experiment (*e.g.*, variety trials) which the farmer must conduct for himself—the Experiment Farm cannot do this for him—and this experiment work supplements, it does not duplicate the work carried out at the Experiment Farm. The writer, previously quoted, very clearly puts this matter in the following extract, portions of which I have taken the liberty to emphasise:—" The experiment station is created to do things which are impossible to the ordinary farmer. It is furnished with costly equipment, and is conducted by men trained in the methods of scientific research, who are made free from other cares in order that they may devote

their undivided energies to helping the farmer. But while there are some things which can only be done by the aid of such an equipment as that of the experiment station, there are other things which the station can never do, and the farmer who profits most by the work of the experiment station is he who is himself an experimenter.

"It is the province of the *experiment station* to *discover* and *formulate* general principles. The **application** of these principles **must** be made by the **farmer** himself. Even were there an experiment station in every county, there would still be hundreds of farms within each county on which some of the conditions would vary from those of the station; and while no farmer should attempt to *duplicate* the elaborate work of the experiment station, neither can any farmer afford to blindly accept the conclusions reached at the experiment station without subjecting some of them to the test of further investigation on his own farm. . . . .

"The farmer of to-day must learn to think, or he is lost, and nothing is more conducive to exact thinking than scientific experiment.

"The experiment station should carry its work far enough to demonstrate clearly the lines which practical application must follow, but after it has reached its *uttermost limit* there will still be *much* for the *farmer* to do."

As the writer pointed out some years ago (*Agricultural Gazette*, March, 1903):—"To conduct an experiment on a farm may appear to be a source of considerable trouble, but, if thoughtfully planned and properly conducted, the trouble can be reduced to a minimum, and the experiment will entail but little extra labour, whilst the value of the information gained will far outweigh the slight extra cost of the additional work. But for the information to be of any value the work done must be thorough; the experiment must be conducted with care and accuracy from start to finish. The plots for the experiment must be accurately measured, the fertilisers carefully weighed and mixed, and then evenly spread over the plots. The resulting crop must be carefully and accurately *weighed*, and *not estimated*. Estimation cannot be relied upon, for very often appearances are deceptive."

That the above opinion, expressed three years ago, was not unfounded, is proved by the evidence of the farmers who have recently planted the experiments at Condobolin and at Temora. At Temora general surprise and satisfaction was expressed that the experiments entailed so little extra trouble. On one farm two experiments (viz., 1 and 3), comprising eight half-acre plots in all, were planted in the morning between 8 a.m. and noon. This is a fact which admits of no argument.

As this class of work is somewhat new to this State, it is likely that a short account of the work which has been carried out this season will be of interest Experiments are being carried out at Condobolin and Temora. Wheat being the principal crop in those districts, the experiments naturally are connected with the cultivation of that cereal. At the request of local associations the writer, by direction of the Minister, visited both places, and at a conference of the farmers interested, learnt what experiments were likely to be

of the greatest value, by supplying the information most desired. The size of plots and methods to be adopted in carrying out the experiments desired were freely discussed. At both places there was a decided feeling in favour of large plots, as being in keeping with the conditions prevailing and implements employed in the wheat belt. At both places half-acre plots were decided upon At Condobolin eight farmers desired to conduct a variety trial with wheats. At Temora six farmers placed 5 acres each at the disposal of the agricultural society for experiment. The sub-committee appointed by the society to deal with this work desired the following experiments:—

(1) A variety trial with wheat.

(2) A trial to demonstrate whether concentrated superphosphate has a more injurious effect upon the germinating power of the seed than simple superphosphate has.

(3) A variety trial of oats.

The Minister having sanctioned the carrying out of these experiments, the following instructions were sent to the different experimenters:—

General Directions.

The ground chosen for the experiment should be typical of the land under cultivation on the farm, and should be as uniform as it is possible to get it.

A very suitable place for most experiments—other things being equal—is near the centre of a paddock which, during the present season, is being cropped with the ordinary crops of the farm. Owing to the likely depredations of rabbits, birds, &c., it is not advisable to have the experiments near any of the boundaries of the paddock, and for obvious reasons it is necessary to have the plots removed from the influences likely to be exercised by growing trees, buildings, &c.

Unless specially directed otherwise, the whole of the plots should be ploughed and prepared in a uniform and in a similar manner to the remainder of the paddock in which they are situated. Thus their preparation can take place at the same time and in the same manner as the remainder of the paddock.

After the preparation has been completed, and just before the planting is to be done, will in most cases be found the best time for definitely marking out the plots.

The plots may vary in size and shape, but are preferably rectangular, and the results from them are more reliable and less affected by inequalities in the soil when the plots are long and narrow than when they are square, or nearly square.

Plots of the following dimensions will occupy ½ acre*:—

(*a*)	Length 220 yards or	10 chains,	width	11 yards or	½ chain.
(*b*)	,, 110 ,,	5 ,,	,,	22 ,,	1 ,,
(*c*)	,, 55 ,,	2½ ,,	,,	44 ,,	2 ,,

* At Condobolin and Temora the farmers had decided on plots of ½ acre in extent.

When the seed is to be planted with a grain drill, the plots *can* and *should* be arranged so that a certain exact number of widths of the drill will exactly plant the area required. For instance, suppose the drill has fifteen tubes, with the tubes 7 inches apart, a round (*i.e.*, two widths) will plant a strip 17½ feet wide, two rounds will plant a strip 11⅔ yards wide; therefore plots—

(*d*) 2 rounds wide and 207½ yards long.
(*e*) 4 „ 103¾ „
(*f*) 8 „ 52 „

will be very approximately ½ acre in area.

It is desirable and convenient to plant longer plots than is required by the area determined upon. Unless this is done great difficulty will probably be experienced in preventing irregular seeding at the ends. If the longer plots be planted, any excess at the ends can be cut off (for hay) by a careful man who can drive the binder to stakes, set so that the end of the knife just cuts to the boundary of the plot required for harvesting.

The width covered by any drill is ascertained by measuring the distance from the centre of the rim of one wheel to the centre of tube (where it delivers grain on the ground) nearest the other wheel.

N.B.—The distance from the centre of the rim of one wheel to the centre of the rim of the other wheel is greater than the width occupied by the crop sown by the drill.

Having decided upon the dimensions of the plots, they should be marked out by placing firm stout pegs at the corners. These pegs should be numbered as required.

For convenience of harvesting, either with a reaper and binder or with a stripper, it is necessary to leave spaces or divisions between the plots. These divisions should be at least 6 feet, and are preferably 9 feet wide. Where the drill is used, such spaces or divisions can be conveniently made by running the drill empty for one width after planting one plot and before commencing to plant the next plot.

EXPERIMENT No. 1.—A trial of five varieties of wheat.

In this trial five varieties of wheat are to be grown under the same conditions, and compared with each other. One of the varieties is to be the one which has been chosen and which is being used by the experimenter for his main crop.

The experiment will require five plots, the centre one of which is to be planted with that variety which the experimenter is using for his main crop.

A different variety is to be planted in each plot. All the varieties are to be planted in the same way, at the same rate, at the same uniform depth, and on the same day.

Plant the varieties as follows:—

Federation	... Plot 1	John Brown ...	... Plot 4
Cretan	... „ 2	Rymer	... „ 5
Main crop variety	... „ 3		

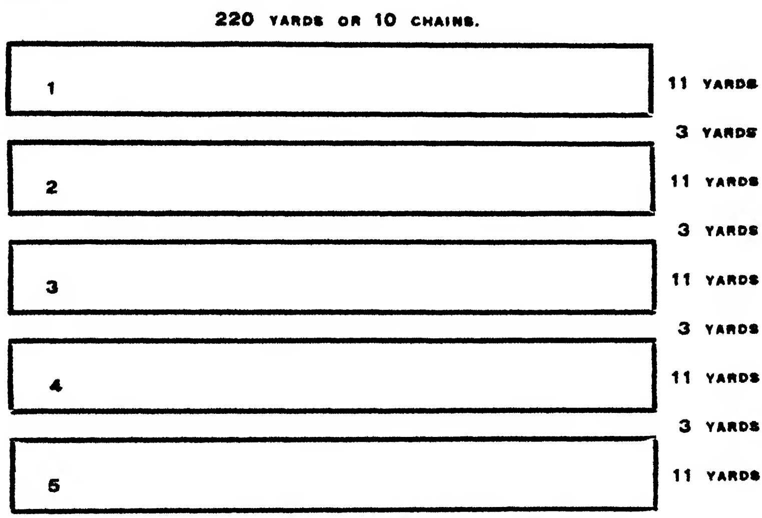
Experiment No. 2.—A trial of five varieties of oats.

In this trial five varieties of oats are to be grown under the same conditions, and compared with each other. This experiment will require five plots.

A different variety is to be planted in each plot. All the varieties are to be planted in the same way, at the same rate, at the same uniform depth, and on the same day.

Plant the varieties as follows:—

Big Four	Plot 1	Abundance	Plot 4
White Ligomo	,, 2	Silver Mine	,, 5
Algerian	,, 3		



Sketch showing arrangement and suitable dimensions for plots in Experiments Nos. 1 and 2.*

Experiment No. 3.—A demonstration with simple superphosphate, and with concentrated superphosphate.

Two plots will be required for this experiment.

On No. 1 plot distribute the contents of bag No 1, which contains concentrated superphosphate.

On No. 2 plot distribute the contents of bag No. 2, which contains simple superphosphate.

The manures should be distributed evenly, in the same way and on the same day.

If distributed by hand, the manures should be sown on the surface and lightly harrowed. They should not be ploughed in.

* The plan of this experiment would be greatly improved, and the results rendered more valuable by having check plots, similar to plot 3, on the outside of plots 1 and 5. This would have been done but when planning the experiment very much greater difficulty in planting the plots was anticipated than was actually experienced. In future experiments the additional check plots will be arranged for.

As far as I have been able to learn, the instructions issued were sufficiently explicit to enable those to whom they were sent to plant the experiments without any difficulty, and though it is intended to issue specific instructions with any experiment which may be authorised, the following general information regarding experiment work is sure to prove useful to those farmers who are interested in this work:—

The Site.

This should be so situated that all the plots will have the same aspect; the soil should be as uniform as it is possible to get it. It should not be perfectly flat, but for best results, should have a slight slope, with just sufficient fall to allow the surplus rain-water to flow off slowly and completely. If the slope is steeper than is desirable, and washing or scouring is likely to take place, the plots should be so arranged that the divisions between them will act as drains.

On account of the manner in which all inequalities cause variation, it is desirable that something of the previous history of the site be known, so that the plots may be arranged to minimise the injurious variations arising from inequalities which have existed. The variation from this cause is least injurious when the inequalities run across the whole of the plots. To have an inequality like an old road, or a boggy depression, running lengthwise of a plot, is to render the results from that plot valueless for comparison with the results from another plot not similarly situated. Sites containing live trees are totally unsuitable for experiment. Any plot intended for comparison should be removed beyond the area affected by a growing tree; such a tree affects a far larger area than is generally supposed. It is unwise to have experiment plots within 1 chain (22 yards) of a live tree.

Check Plots.

The object of an experimenter is to so arrange the plots in an experiment, that the conditions obtaining in each one are the same, except in one particular, in order that the variations due to this particular difference of treatment may be observed. In field experiments it is not possible to do this, on account of those disturbing influences over which we have no control, There is every probability that the farther one plot is removed from another the greater will be the difference in the conditions obtaining in each.

In consequence of this, comparisons between plots become the more valuable and reliable according as the distance between them decreases. It follows, therefore, that for best results, plots to be compared with each other should be adjacent to each other. It is, however, impossible to have all the plots in an experiment adjacent to each other, but it is possible and very desirable to have each plot adjacent to one of a series of plots, each of which have been treated (as far as it is possible to do so) in precisely the same way, and with which it can be compared. These plots are called check plots, and for

best results should be placed alternately with the other plots in the experiment—so that each plot under treatment has a check plot on both sides of it. The next best plan is to have every third plot a check plot, so that each plot under treatment has a check plot on one side of it.

In the case of variety trials these check plots should be cropped with some common standard variety—preferably one about which a good deal is known, especially, with regard to its suitability for the district in which the experiment is being tried. In fertiliser trials the check plots may be either a series of unmanured plots or a series of plots manured with the same simple or mixed fertiliser.

Size of Plots.

The size of the plots will be governed largely by the character of the farming carried on by the experimenter, by the size of the areas cropped, and by the implements in use.

I find that there is a general feeling amongst farmers, especially in wheat districts, in favour of large plots. This is no doubt due to the fact that our farmers are accustomed to deal with large areas, and hence feel repugnant to handle small lots of seed.

Whilst it is quite true that an experiment for a farmer must be planned to suit the implements he uses, it is also equally true that large plots are unnecessarily wasteful and undesirable. It must be remembered that some of the plots in an experiment will not be profitable, therefore, to increase their size beyond the point which is essential for thoroughness or reliability, is to increase the loss which occurs on such plots. Again, the seed of new varieties of crops is rarely plentiful or cheap. If, therefore, a large plot be insisted upon it means the delay of at least one season before the possibilities of a new variety can be determined, or it means a larger increase in the cost of the experiment than is necessary. Another and a very serious objection to large plots is the fact that the difficulty of giving each plot the same uniform treatment, at about the same time is greatly increased.

The reasons which render it necessary to have check plots make it desirable to have narrow plots. It has been found that if the plots be very wide it is quite possible that there will be a greater difference between the two halves of such a plot than there will be found between plots treated in different ways. The ideal width is the width necessary for one row of plants, and the nearer our farm implements allow us to approach this width the more satisfactory and reliable will the experiments be.

Provided the necessity for having the plots narrow is not lost sight of, their area may be as large as the ground will admit, but for all practical purposes quarter or half-acre plots will be found quite large enough, and quite in keeping with the implements in use on any of our farms. It is undesirable and unreliable to have the plots less than one-fortieth of an acre.

Whilst plots which are only as wide as the drill (half-round) will be more satisfactory and will furnish more reliable results than a wider plot, yet

when all the circumstances surrounding a farmer's experiment are considered, the width which will give the most all-round satisfaction will be twice the width of the drill, *i.e.*, a width requiring one round of the drill to plant it.

The following table gives the dimensions of half-acre plots, with the different size drills on the market:—

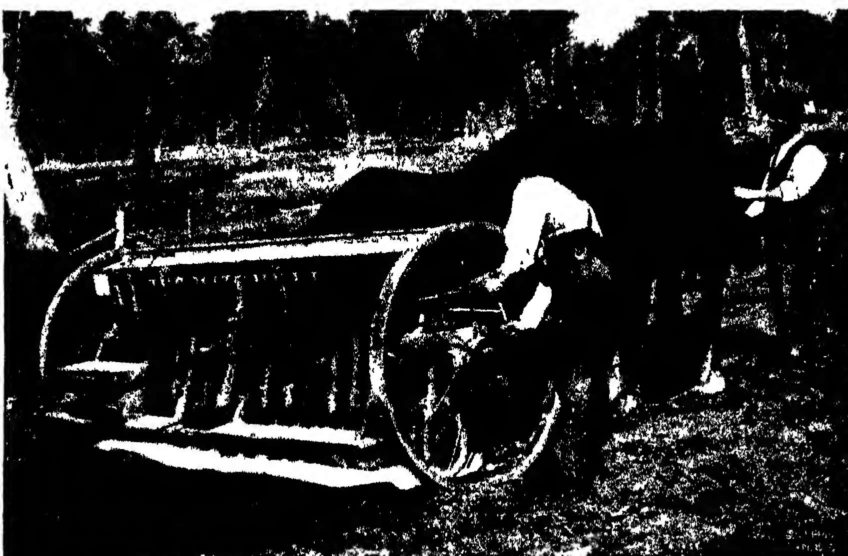
Size of Drill.		Dimensions of ¼ acre plots.				Dimensions of ½ acre plots.			
Number of tubes.	Distance apart.	Width.	Length.	Width.	Length.	Width.	Length.	Width.	Length.
	in.		ch. yd.		ch. yd.		ch. yd.		ch. yd.
12	7	½ round..	23 12½	1 round ...	11 17¼	½ round...	47 3	1 round...	23 12½
12	8	½ ,, ...	20 13¾	1 ,, .	10 7	½ ,, ...	41 5½	1 ,, ...	20 13¾
13	7	½ ,, ...	21 16½	1 ,, ..	10 19¼	½ ,, ..	43 11	1 ,, ...	21 16½
13	8	½ ,, ..	19 0¾	1 ,, .	9 11½	½ ,, ..	38 0½	1 ,, ..	19 0¾
14	7	½ ,, ..	20 4½	1 ,, ...	10 2¼	½ ,, .	40 9	1 ,, .	20 4½
14	8	½ ,, ..	17 15	1 ,,	8 18½	½ ,, ...	35 8	1 ,, ..	17 15
15	7	½ ,, ..	18 18¾	1 ,, ..	9 9½	½ ,, ...	37 15½	1 ,, .	18 18¾
20	7	½ ,, ...	14 3	1 ,, ...	7 1½	½ ,, ...	28 6	1 ,, ..	14 3

Divisions and Headlands.

Between small plots and where ground is scarce and valuable, divisions 2 feet wide will be sufficient, if provision be made at convenient intervals, say, of every ten plots, for the passage of implements, machinery, and vehicles. For this purpose wider divisions (9 or 10 feet) should be left; any particular plot intended for comparison should never be used for this purpose, as the passage of the implements and the tramping of horses will make the physical condition of soil where it occurs quite different from that of the other plots; the results obtained from it will, in consequence, be quite valueless for comparative purposes. The land occupied by these larger divisions need not be wasted, for after the experiment plots have been planted these divisions may be sown with some crop which should be harvested separately and kept apart from the crops grown in the experiment plots. To facilitate the harvesting of wheat experiments it is desirable to leave wider spaces between the plots. If the stripper is to be used, 6 feet will be quite enough. If the reaper and binder, it will be necessary to leave 9 feet in order to prevent the sheaf being thrown into the adjoining crop. A convenient way of marking divisions between plots is to run the wheat drill empty for a trip, after finishing the sowing of one plot and before commencing that of another. To increase the width of the division the wheel may be run in the wheel mark. Wide headlands, say 18 or 30 feet, should be left at both ends of the plots.

Planning out the Work.

Before commencing any of the work connected with the experiment a plan of the site (preferably to scale) should be prepared; on this the plots should be marked and numbered, and the treatment to be accorded to each set out. If this be done the work can be arranged in the simplest and best manner, a better grasp of the work will be obtained and probably some oversights will be remedied. The work will certainly be done more expeditiously and in a better way, from the fact of a plan having been prepared and thought over before the work was commenced.



Emptying the seed-box.

Ploughing and Preparation.

All operations connected with experiments, if they are to be uniform, can only be of one description, and that is the best. The ploughing of all the plots should as far as possible be done at the same time—a difference of a few weeks in the time of ploughing may cause more difference in the resulting crop than the difference in the treatment of the plots will cause.

The ploughing should be uniform and thorough, and if possible across the direction of the plots. If this cannot be arranged, it should be set out so that the ridge or back-up, and the clean-out come in spaces intended for divisions between the plots. A ridge or a clean-out will cause so much difference between the condition of the ground on which it happens to be and that of the other ploughed ground, that any plots on which these occur will be quite unsuitable for comparison with the other plots. Plots containing ridges or furrows

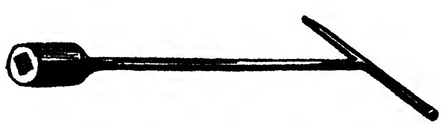
should be treated as being quite distinct from the experiment, and the results from them should in no way be considered as having any bearing upon it. Any plots containing dead trees, stumps, or stones, should be treated in a similar manner.

It is almost impossible to so arrange that the drill will start sowing at any given point; it is, therefore, desirable that the sowing extend for a short distance beyond the ends of the plots. Before harvest this excess at the ends can be removed. With wheat and oats this can be done with a reaper and binder, driven by a careful man, to stakes set so that the end of the knife will cut to the boundary of the plot.

Drilling.

The drilling should be as good as it is possible for a skilful man to make it. It should be straight, otherwise one row is likely to run into another, and the inequalities, differences in rate of seeding, and in the area of land planted are introduced.

The difficulty of cleaning out the seed-box is entirely removed if a cross-handled key like that shown in the illustration is available. If the machine be thrown out of gear and this key fitted on to the square spindle which drives the seeding mechanism, the seed box can be emptied at quite a rapid rate. Any blacksmith can make such a key; so useful is it that every farmer who owns a drill should possess one; it is useful for trying a drill which has not been used for some time, in order to see that no obstructions have by accident got into the seed cases. In this way many a breakage may be saved, and it is probable that in a single season it will save him many times its cost, which will be about 3s.



Key used in emptying seed-box.

Distribution of Fertilisers.

This can be done more expeditiously, more regularly, and more accurately with a machine than by hand, and without having to wait for calm weather. In order to facilitate the distribution, and also in order to render a number of calculations and adjustments unnecessary, it is advisable to increase the bulk of the fertiliser by the addition of a considerable quantity of sand or of dry soil from the plot, at the same time making all the mixtures up to the same pre-determined bulk. The amount required for the plot can be determined by putting a measured quantity of fertiliser or sand in the box and then driving the drill over a piece of ground having the same dimensions as the plot. The bulk required is ascertained by subtracting this residue which is left in the drill from the measured quantity which was put in the box. The quantity of fertiliser intended for each plot should be made up to this bulk.

As it is impossible to completely empty the fertiliser box and, at the same time, distribute the fertiliser evenly, it is necessary to mix up more fertilizer than is actually required for distribution on the plot. The extra amount required will need to be sufficient to cover the tops of the feeders or cups. This extra quantity will not be wasted; after the requirements of the experiment have been met, the residues can be mixed and applied to the commercial crops of the farm.

As far as is known there is no better way of cleaning the fertiliser box out than that of removing the plates and feeders or cups, and then with a small brush sweeping what is left through the holes leading to the tubes. This is not quite such a formidable task as one, before trying it, is apt to imagine. Two men can thoroughly clean out the box and replace the fittings in a fifteen-tube drill in five to seven minutes. When replacing the cups or feeders care should be taken to turn them *backwards* as far as they will go; this will ensure that they start to revolve immediately the drill is set in motion.

Cleaning out fertiliser box.

Harvesting.

If the plots have been arranged as suggested, no difficulty will be experienced in harvesting them in the same way and with the same implements that are used for harvesting the main crops of the farm. The produce from each plot should be kept quite separate until *carefully weighed* and the weight recorded.

Comparing Results.

To estimate the differences due to the different treatments accorded the plots, it is advisable not to compare the yields of the plots one with another, but to compare the differences which exist between the actual yields of the plots and the yields which it is estimated these plots would have produced had

they been planted as check plots. This estimated yield will be based upon the assumption that the differences between neighbouring check plots is due to regular and similar variations in the soil between them.

Conclusion.

Any details, dates of ploughing, planting, &c., should be recorded in a book kept for the purpose, or on a plan of the experiment; nothing should be left to memory, for the best memories are likely to play tricks at times and fail us. Neither is it safe to trust to what is recorded on the pegs or labels, for these are likely to be misplaced, or removed, or lost.

No farmer should be satisfied with the result of one season's experiment. The peculiarities of one season may cause quite different results which will be obtained during a series of years, and what is required is information relating to the conditions which are the average or which are those of a series of years.

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U.S. Department of Agriculture. "Essentials of Field Experimentation," by C. E. Thorne, M.S.A., 1905.

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Dairy Notes.

The Progeny of Government Stud Cattle at Sydney Show.

M. A. O'CALLAGHAN.

In a recent issue I referred to some cattle the progeny of State-imported bulls that were exhibited at Sydney Show. The illustrations in this issue represent some non-competitive exhibits shown by the Berry Stud Farm. The Guernsey bull, Calm Prince, is, perhaps, the most interesting. Photographs of him have appeared as a yearling and as a two-year-old. Now he is represented as a three-year-old, and it will be seen that he has filled out into a

Guernsey Bull, Calm Prince.
By Rose Prince (imp.), from Gentle (imp.).

very handsome beast. He possesses size, substance, and symmetry, as well as dairy qualities. He stands over as much ground as many Shorthorns, and he will measure most bulls of larger breeds from the hip to the pin bones. He has deepened considerably, and has now that robust vigorous appearance so much liked by dairy farmers. A yearling full brother to Calm Prince has recently been sold to Mr. J. Kinross to be used on his farm at Jamberoo. On next page is seen a photo of a two-year-old sister. She is a breedy typical Guernsey, full of quality, and is bound to grow into a good dairy cow.

The young Shorthorn bull, March Pansy, and his grand-dam, Pansy 4th, imported, are also shown. As readers can see, Pansy 4th looks every inch a

Guernsey Heifer, Calm 2nd.
By Rose Prince (imp.), from Gentle (imp.).

dairy cow, and she is bred on undoubted Shorthorn lines, being by Umpire 13th (64934) out of Pansy 2nd by First Favourite (54310) (Coates' Herd

Shorthorn Bull, March Pansy.
By Earl March, from Australian Pansy.

Book). This cow has a record of 60 lb. of milk in twenty-four hours, and as it is now eight years since she was imported, and she has bred a calf every

year, it goes without saying, that she has been a fruitful animal of good constitution. She was bred by Wm. Arkell, Fairford, England. Her grandson, March Pansy, is by Earl March, from Australian Pansy, a very fine young

Pansy 4th (imp.)
Grand dam of March Pansy.

cow who gave 582 gallons of milk in one season on her first calf. This young bull, then, is by the same sire as Quick March referred to in a previous issue as having been sold for £100 as a yearling. March Pansy is a rich red in colour. He has gone to the Grafton State Farm to do stud duty in the near future.

Poultry for Export.

G. BRADSHAW.

CHAPTER I.

Retrospective.

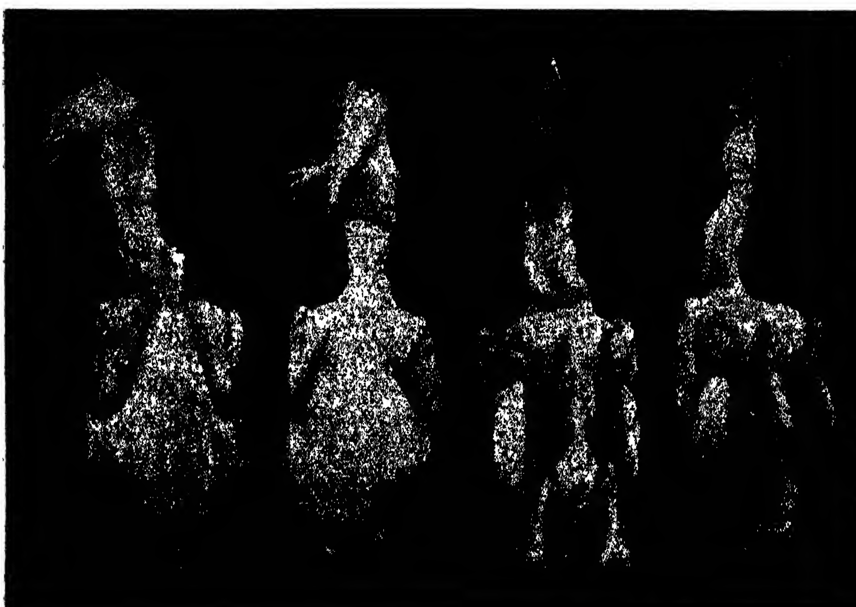
IN October of 1904 I contributed to the *Gazette* an exhaustive article with the above title, not that we had any more poultry to export then than we have now, but rather to place before the newer poultry-breeders of the State the actual conditions from the paying point of view governing that branch of an unsatisfactory industry. At that time, through reading in papers about the profitableness of the hen as shown by the laying com-

A case of 12 Chicago Plymouth Rock Chickens as opened in Sydney. Papers removed from heads of four. Graded to within 4 oz

petitions, quite a number of people new to poultry-breeding had entered upon the business, with every hope of success. They read and re-read the figures, and by the simple rule of three, made calculations which warranted them in embarking in an industry which, if not an assured avenue of wealth, had at least great possibilities.

These new patrons of the hen, whether they found her production in accordance with their expectations, is not bearing on this paper, as were the developments Some of these recruits purchased eggs, and others stock, from the vendors of the good laying strains, and in the natural

course began breeding their own layers. But then came the contretemps: it was found that to get one or two hundred laying hens the same number of cockerels had to be reared, the securing of a satisfactory price for the latter being considered by many at least one cause of their disappointments in the business. Inquiries and suggestions about the Government making experimental shipments to test the London markets were frequently received, these newer breeders being unaware that, so far as this State's poultry was concerned, the days of experiment were long past, some of the breeders being surprised when told that, years previously, shipments of thousands of New South Wales poultry had been successfully shipped to London; that it arrived excellently, and that the very highest



Four Chicago Chickens taken from case, showing fatted back and well-fleshed breast.

encomiums were given it, as to its quality and preparation, by the London salesmen, and, chief of all, that the bulk of it paid the senders well. Inquirers were told that the Agricultural Department still prepared poultry for export, but that the quality the breeders complained of as fetching low prices in Sydney would not be good enough for London requirements; and when shown the net returns from London, and the wait of at least four months for their money, shrugged their shoulders, and preferred to, as one said, "go on as I am." The above was the chief prompting factor in the thirty-page article above referred to, the following extract being from the opening page:—

"Within the past twelve months inquiries on several occasions have been made on the above subject, some of the questioners expressing wonder that there were no fowls being shipped, while others have put the

queries in such a way as to infer a reflection on something or somebody. A most extraordinary thing is that some of the querists were unaware that there were none to export, or rather that it paid better to sell them here, for, as I have written on another occasion, people do not send their goods to other countries merely to show the productiveness of their own, but rather with the expectation of realising more money for them than if marketed locally. This brief reply might be sufficient for all purposes, but other developments have in the meantime ensued, warranting more detailed treatment, and the present contribution on the subject is purposed as a reply so exhaustive as to embrace every phase of the question, and based not on vague theories as to the prospects of an export trade in poultry products, nor yet on some perhaps lucky individual experiment, but rather on the results of actual extensive operations covering several seasons, and embracing cycles of both fat and lean years, consequent on the meteorological conditions of the country. When in 1897 export poultry trade facilities were provided by the Hon. Sydney Smith, high hopes of its prospects and possibilities were indulged in. The country, suburbs, and city were literally full of fowls, resulting from a series of bountiful years, and the corollary of low-priced cereals and other foods, which, in the absence of more remunerative markets, were fed to fowls. These in turn became plentiful to a degree much exceeding the local demand, with the inevitable reduced value, that it was then asked, and with more seriousness than ever since, will poultry-keeping pay? Anyone taking their memory back to the date mentioned and earlier years will recollect that hens were sold at 1s. 9d. to 2s. 3d. per couple; young fowls, 1s. 6d. to 2s. 9d.; choice to 3s. 6d.; ducks, 2s. 6d., 3s., and 3s. 3d., and other like goods correspondingly low, and in striking contrast to the Saturday papers of 3rd September this year, which read as follows:—Old hens to 4s. 6d.; choice, 5s. 1d.; English ducks, 4s. 3d. to 5s.; suburban to 5s. 8d.; Muscovy, 5s. 9d. to 7s. 6d.; suburban, 8s.; choice, 9s.; prime young roosters to 7s.

"That the prices prior to 1897 were not remunerative was apparent to those in authority in the Agricultural Department at that time, and prompted the acquisition of the present cool stores for the treatment of these and other small products, but in reality, so far as poultry is concerned, a big industry."

The first actual operations of the Department was the offering of substantial prizes at the Royal Agricultural Society's Show, in 1897, for poultry packed for export. There were several exhibits, some packed in huge cases, which, if exported, the freight alone would have left nothing for the growers; others were trussed ready for cooking, which would have been disastrous to their reception in London. Size appeared to be the chief consideration of the exhibitors, the birds being of all ages and quality, while, through want of experience, the preparation was at fault. The Department, prior to the exhibition, had purchased a few cases of fowls and ducks, and had them prepared in the manner then approved of

for London. Following this, regulations were provided, showing the class and quality required for London, and now, almost a decade since their first issue, they are as applicable as when first formed, as confirmed by the Agent-General's report of the late *Daily Telegraph* shipment, which is the principal subject of this article.

[*Extract from Regulations*, 1897.]

Poultry.

Must be young. *Fowls* from three to five months old, well-fed, and not under 3½ lb. each, live weight. Older birds, or those in poor condition, will be rejected by the grader.

Ducklings should be from ten weeks to five months old, weighing not under 4 lb. each, live weight. The younger birds give the better prices. White ducklings are most admired in the English market. Old birds will be rejected.

Goslings should not be over six months old, and should weigh not under 10 lb. live weight.

Turkeys.—Gobblers must not be over ten months old, and should weigh not less than 13 lb.; hens not under 9 lb. live weight. If young, the heavier the bird is the better price can be got in proportion.

All fowls must be sent *alive* to the Export Depôt, where the Expert will receive, grade, kill, pluck, prepare, and pack them. The Board will find the cases, freeze, and ship the birds at the following uniform rates, which must be paid by the owner or his agent before shipment:—

Fowls and Ducklings, 6d. per pair. Geese and Turkeys, 1s. per pair.

This covers all expenses except railway freight.

Best Time for Shipping.

Fowls and Ducklings—December to April.
Goslings—December to April.
Turkeys—September to 1st November (to reach London for Christmas markets).

Quantities.

The following are the numbers usually packed in cases for export, and shippers would do well to regulate their consignments accordingly:—

Fowls and Ducklings, 20 in crate. Turkeys, 8 in crate.
Goslings, 10 in crate.

The owner or his agent must in all cases undertake the procuring of shipping documents, payment of freight, and all charges before shipment, also the receiving and disposal of all rejected carcases, which must be immediately removed from the Depôt.

The Board for Exports will not undertake shipment to any particular salesman or firm, but will furnish any desired information as to probable markets and reliable agents for the sale of produce exported under its auspices.

Immediately after the issuing of the regulations, an exhaustive pamphlet on poultry-breeding for the local and English market was published by the Department, giving many directions as to breeds, breeding, &c., the advice, prices, and predictions being as applicable at the present day as when they were issued.

On export marketing, the following Sydney prices and comments were given, and anyone comparing them with those which obtained on the same date of the present year will readily agree that nine or ten years ago there certainly was need for exporting:—

7th January, 1897, Sydney.

Fowls, 2s. 6d. to 3s. 6d. per pair. Turkey hens, 4s. to 5s. per pair.
Ducklings, 2s. 6d. to 3s. 6d. per pair. Gobblers, 7s. to 10s. per pair.
Geese, 3s. to 5s. per pair.

In seasons of low prices for cereals, poultry can be reared profitably, at figures even lower than those now ruling; but, speaking generally, should

poultry become much more plentiful, the Sydney prices will become unprofitable, and we will have to look about for markets beyond Australia, as has had to be done in connection with our meat, butter, and other produce; and the same process—the refrigerating chambers—which has for a number of years landed the above perishable products in the world's market, has already come to the poultry-breeders' rescue.

Speaking generally, in England poultry all the year round are as cheap as in the Colonies, and the only reason why we can at all attempt an export trade is that the winter months there are not favourable for hatching, with the result that in March, April, May, and early part of June, chickens and ducklings cannot be had except in small numbers, and with the opposite seasons here, our poultry are the most plenteous and cheapest at that time; consequently, there is no reason why we should not largely cater for this trade, which has unlimited dimensions. One fact must be mentioned: should the English winter be an open one, and favourable for poultry-breeding, prices go down, as they did during the past season. Still, if producers here would but give more attention to breeds and breeding, there is no reason why we should not be able to place our poultry profitably on the Home markets, in the months mentioned, irrespective of the temperature of the English winter.

As already said, it is the scarcity of chickens and ducklings in England at particular seasons which appeals to us, not the scarcity of table fowls, as understood here, which may mean birds from 8 months to any age. In March and April the English markets are stocked with good and fat birds, late hatched in the preceding year, from 7 to 8 months old, and however these may be valued in Australia for the table, in England they are not chickens; certainly there would be a sale for such were they sent Home, but why keep and feed poultry for eight months if a better price can be obtained at from 18 to 24 weeks old? English people, at the season noted, will pay a good price for suitable goods, and in the case of chickens they must be under 6 months old; and to this effect, they must be well fed every day of their lives from the time of hatching, and be fat and in otherwise good condition when sent to be killed. Nothing under 3½ lb., live weight, should be forwarded, and at from 5 to 6 months old, chickens of good table sorts should weigh 6 lb. each. Ducklings should have a minimum live weight of 4 lb., and if Aylesbury or Pekins, or a cross from these varieties, be bred, with good feeding they should weigh 6 lb. at from 3 to 5 months old. The following is the monthly wholesale price, received by Messrs. Brooke Bros., Leadenhall Market, London, during the year 1896, for prime chickens:—

	s. d.		s. d.			s. d.		s. d.	
January	3 0	to	4 0	each.	July	3 0	to	3 6	each.
February	3 0	,,	4 0	,,	August	2 3	,,	3 0	,,
March	3 3	,,	4 6	,,	September	2 6	,,	3 3	,,
April	4 3	,,	5 6	,,	October	2 6	,,	3 0	,,
May	4 0	,,	5 0	,,	November	2 6	,,	3 0	,,
June	3 6	,,	4 3	,,	December	2 9	,,	3 3	,,

The same firm supply the following for ducklings:—

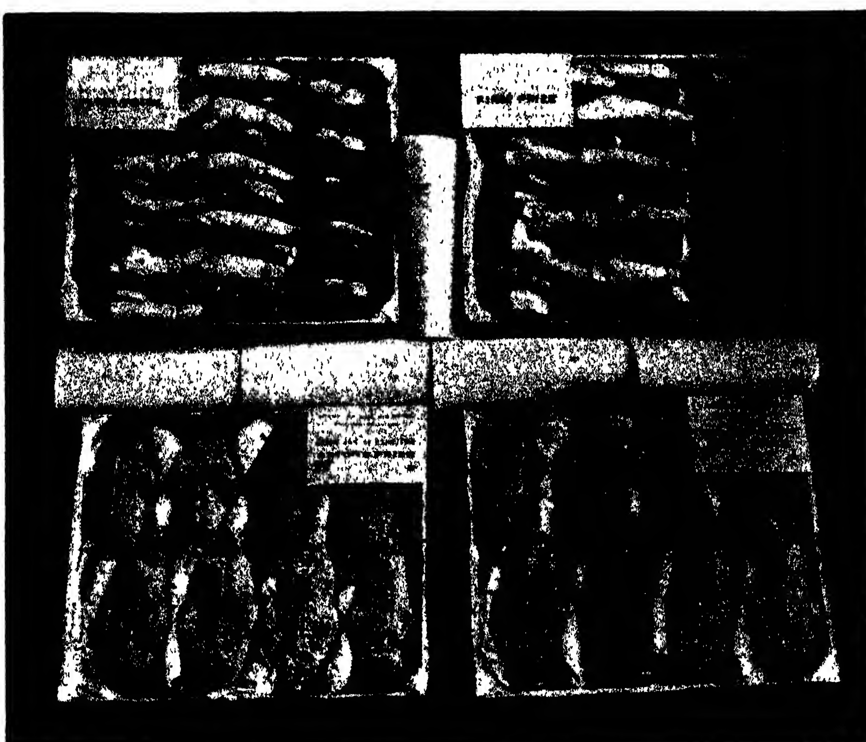
	s. d.		s. d.			s. d.		s. d.	
January	3 0	to	5 0	each.	April	6 6	to	10 0	each.
February	3 6	,,	6 0	,,	May	6 0	,,	8 0	,,
March	4 6	,,	8 0	,,	June	5 0	,,	7 0	,,

The above were all well-grown Aylesbury ducklings, and young.

CHAPTER II.

Early Shipments.

THE first shipment under the supervision of the Department comprised a quantity of ducks. These were from a breeder in North Sydney. Many and varied were the opinions expressed as to their reception in



New South Wales Chickens and Ducklings, as packed for export at the Government Export Depot, 1898.

London. However, in due course a cable reached the Department that they had realised 8s. per couple, a price much beyond the most sanguine expectations, particularly as the extreme value of the goods then in Sydney was 3s. to 3s. 3d. per pair. A rush immediately commenced, and in a few months quantities numbering several thousand head, representing some 300 breeders, were exported. The later lots arriving at a more plentiful time, fetched 6s. 1½d. But even this drop from the early

consignment, although expected, left a good margin to the exporters over that ruling locally. One large duck-breeder at the time publicly stated that, under the prevailing circumstances, 2s. 9d. per pair net would pay him.

Later shipments consisted of chickens, and in 1898-9 there was quite a rush to London, Colonial game chickens, bred by Mr. Hall, of Bathurst, fetching 6s. per couple, while later shipments arriving in April, May, and June fetched the same price. Amongst the many thousands there were but few pure breeds—indeed, the bulk of them were the veriest mongrels; but all were kept strictly within the Department's regulations —under 5 months of age. The illustrations given will show the small plump carcass as opposed to the older, larger, and thinner ones of this year's shipments.

Almost every mail brought appreciation of the 1898-9 shipments, preparation and quality being always acknowledged. The following extract from the second edition of "Profitable Poultry Breeding" will be opportune:—

"I have already acknowledged that, within the past two years, both city and country Press have done much to encourage a more business-like system of poultry-breeding for both the local and export trade, and possibly none more than the Sydney *Daily Telegraph*, a member of whose staff pays regular visits to the Export Depôt, and there witnesses living illustrations of the thousands of the ill-fed, ill-bred, stunted chickens which regularly reach Sydney, and are a disgrace to the producers. Of that paper's numerous appeals to poultry-breeders to produce better goods, the following from a recent issue should be a valuable addition to this chapter:—

"'The very favourable reports which have been received regarding the small consignments of fowls—or chickens, as the English poulterers speak of them—sent to London during the season just closed, should dispel any lingering doubts as to the practicability of a good trade being done in that direction, and there need be no longer any hesitancy on the part of poultry-farmers to lay themselves out to cater for it. As has already been reported, the chickens sold at the end of March realised 6s. per pair, and the selling agents expressed the opinion that had they been forward a month to two months earlier, they would have readily commanded 8s. Of course, the fact must not be overlooked that the market in London this year has been a good one, owing to lighter Continental supplies, and it may be said that these prices would not always be forthcoming. True; but the average prices in London for prime quality during the months of February, March, April, and May are sufficiently high to provide remunerative outlet. Then, again, the chickens, regarding which the reports were received, were, as we know from inspection prior to shipment, a very ordinary lot, and not by any means the best that is and can be produced here. Frequently, we might even say at almost every auction

sale, better young fowls are sold in the open market. Yet these chickens have been classed in London as superior to Russian, Austrian, or Canadian, and it may, therefore, be reasonably concluded that with the best quality our breeders do and can produce, these competitors might easily be outstripped, and prices rather above the average secured. There is no market in the world where top quality will command top prices more freely than in London. And the extent of the market awaiting us may be imagined when one firm writes :—"We must have large quantities of these chickens; we can do with 500 crates a week." This quantity only represents 10,000 head, or more than New South Wales is likely to export in a season for two or three years to come. However, the market is there, and this Colony can produce cheap feed, and surely the converting of that cheap feed into poultry can be made a source of profit.' "

The *Daily Telegraph* continues :—"The scarce season in England commences at the end of February, and shipments from here should begin as soon after the new year as possible, and as chickens from 15 to 18 weeks old are required, hatching should be in full swing in August.

"The main thing is to produce birds that will turn out plump at an early age; the colour of feet and skin may be treated as a secondary matter. The watchword for the export trade should be uniformity of size and appearance, and quick-developing, plump-breasted birds. Indian, Colonial, Malay, or Old English Game are recommended as the breed to cross with Orpingtons or others for the best results."

Pages of the *Gazette* could be filled with the most flattering notices from the above paper, on the quality of the goods, all based on the London reports. The following extract from the issue of 12th August, 1899, will suffice, and entitled "Sydney Chickens in London":—"Mr. J. J. Horrocks, of Equitable Buildings, the local representative of Messrs. C. E. Brooke and Son, Leadenhall Market, London, has furnished us with the following extract from a letter dated London, 7th July, received from his principals by this week's London mail :—'The chickens *ex* "Australasian" made 4s. each, and were very fine. Only get them here earlier, and any quantity can be sold at from 4s. to 5s. each with no difficulty. They are the finest frozen chickens that came to our market, and the way they have been killed, dressed, and prepared is deserving of every praise. Although there have been large quantities of Canadian, Russian, Hungarian, and other varieties, there is no comparison between them and the chickens that come to us from Australia. I hope you will be able to get us large supplies for the forthcoming season.' This is good news indeed. The chickens referred to were shipped by Messrs. Boyd, of Gosford; Gray, of Paterson; and Hoffman, of Parramatta. They comprised a lot of good-sized birds, carrying plenty of meat, but were a mixed lot, and not by a good deal the best that could be sent from here. The 'Australasian' took the last shipment from Sydney. She left on 5th May, and the birds were sold during the first week in July, which is quite the tail end of the London season for frozen poultry. Considering that these birds, which

could not be classed as the primest, realised so late in the season a price that will clear the breeders here over 6s. per pair, all doubts about there being a profitable outlet in London for Colonial poultry should be dispelled, more especially in view of the fact that the agents, as stated above, are confident of realising prices equivalent to over 8s. per pair to the breeder, if the birds are only placed on the market earlier."

In addition to the above, all the city and country Press indulged in high hopes of a successful and permanent trade being established in poultry products, and gave due prominence to the developments and possibilities of this hitherto much-neglected industry. Indeed, it was conclusively demonstrated that our poultry could be put on the English market as fresh, tender, and sweet as the day it left the poulterers' hands, and that poultry of whatever breed, if young and meaty, could, during certain months of the year, be put on the London markets profitably, and that the Home markets, so far as Australia is concerned, could not be overstocked. From all the above it will be seen that everything was promising for a permanency in the export industry—poultry plentiful, transit conditions good, and, chief of all, the market a paying one.

Shipments continued to follow, and although some were not up to the earlier lots in quality, the prices received were better than those obtaining locally. However, the inevitable rise took place in the Sydney markets through the fowls becoming scarcer; then there were delays in the payments from London, unsatisfactory explanations, and, at least in one instance, actual repudiation, with the result that, so far as the London trade is concerned in poultry from this State, there has been a comparative standstill. However, one benefit still remains. Quite a number of the then poultry exporters, realising the advantages from the cold-storage system, still patronise it, by storing their goods in the cheap periods, and holding them over to the dear time, as they do with that other product, eggs, this large and ever-increasing trade, and remunerative system to the poultry-breeders, being also incepted by the Agricultural Department simultaneously with the grading and preparation of poultry. But why, it may be asked, all this ancient history? Just to show the numerous new recruits to poultry-breeding, who are not aware of the fact that the export question of this product has for many years been placed outside the región of doubt, a good London market always awaits good products. During 1900 the exports to London had comparatively ceased, and those who were directly interested, the market poultry-breeders, knew why. Fowl foods had got high, local prices for poultry improved, and unsatisfactory London agents being the principal causes. However, there were some who did not know, principally fanciers, and these people being always kindly disposed to their more harder-worked compeers—the market-poultry men—believed they could stimulate the London export poultry trade as apart from the fancy business, by holding an annual export show. Such was duly incepted by the Poultry Club of New South Wales, and received the well-deserved Press encouragement for the proposal. A

comprehensive schedule was issued, good prize-money offered, and everything pointed to another export hum to London. The show eventuated in the Masonic Hall, on 8th and 9th February, 1901. But what was the result? Just what any market poultry-man knew. Some seventy exhibits turned up, and from less than a score of breeders—all fanciers—the men in whose interest the show was got up being religiously absent.

The poultry were excellent. It was not a matter whether it paid to rear them or not; all were after the prize cards, and every exhibitor got some. However, except Mr. Falconer, not one of the exhibitors exported a fowl. This breeder sent two cases of good Wyandottes Home, and realised 8s. a couple for them; but whether this paid him or not, such was his first and last experiment. The Poultry Club, realising the indifference of those who should have been interested, wisely decided to make the first export show their last one. This now ends the history of the English export trade. Just here it would be difficult to determine the exact number which went to London through the Agricultural Department since the inception of the business in 1897. However, to those who talk and write of an export trade as something coming, the following figures will be a surprise. The extract is from the *Daily Telegraph* of 1901, referring to the exports for that year. The figures given are up to December of last year.

"Figures speak for themselves. The returns of poultry dealt with at the Government Export Depôt during the past year show that the export trade is forging ahead by leaps and bounds. The expansion in shipments for 1901 exceeds that of any previous year, the fine record of 73,140 head having been attained, as against 44,504 in 1900. Even this does not nearly represent the total volume of exports, as large quantities were shipped independent of Government supervision. If the returns of these outside consignments were available it would probably be found that something like 100,000 head had been despatched oversea from Sydney. The following table shows the quantities put through from 1898 to 1905, inclusive.

Poultry (Head) Packed for Export at Government Cold Stores.

1898	Poultry	16,753	1902	Poultry	120,161
1899	,,	22,808	1903	,,	4,487
1900	,,	44,505	1904	,,	3,928
1901	,,	73,140	1905	,,	17,616

Possibly some may say, in the years of big numbers the bulk went to South Africa. This is quite true, but it must be known that the Department does not influence people where to send their goods. All the Department does is to prepare and grade for the known requirements of the various markets, and wherever poultry or other goods be exported to, the simple commercialism obtains that they are sent where it is thought they will pay best.

CHAPTER III.

Table Poultry Competition.

IN all the writer's contributions on poultry, attention has always been drawn to the miserable quality of the large bulk of those sent to the Sydney markets, the personal belief being that many of the breeders attempt too much, *i.e.*, hatch many more than their accommodation and other arrangements are capable of coping with, the large quantities having to share the management and food that the smaller numbers should have ; however, from whatever cause, the quality is wretched. It was thought that the export of the many thousands of mongrel hens to South Africa a few years ago, and supplanted largely by pure breds, would have benefited the quality. This has not been the case, as can be seen any auction sale day, for the ordinary barn-doors of no particular breed fetches an amount equal to that of the pure breed of same size and weight, while of the ten thousand or more fowls handled at the cold stores during the past year, fully one half of them were Orpingtons and Wyandottes of the various colours, and when plucked were undistinguishable from those of mixed pedigree, the one apparent want being a more liberal feeding. The daily paper so freely quoted in this contribution, evidently realising this lack of quality in table fowls, in an issue of August last year had the following article :—

TABLE POULTRY COMPETITION.

"In the rapid development and evolution of the poultry industry of the State during the past few years there is one weak point that has forced itself upon the consideration of all interested with increasing persistence. This is the unsatisfactory position of the table poultry branch. That the average quality of the table poultry produced is far below a desirable and attainable standard there can be no two opinions. They are many things which have conduced to this regrettable state of affairs—they need not be recapitulated just now—and the stability, progress, and success of the industry depend very largely upon improvement in this direction.

"It is a general complaint among poultry-farmers that it is no use producing really first-class table birds, because commensurate prices cannot be obtained. In short, under the present system of selling, the really prime or choice birds do not fetch prices that are in keeping with the quality, in comparison with those paid for medium and ordinary birds.

"It is our desire to see well-directed efforts made towards making the production of really first-class table fowls more general, and, in order to arouse an active interest in this work, it has been arranged to inaugurate a series of table poultry competitions, the object of which will be to give a direct incentive to, as well as to assist, poultry-farmers in the adoption of better methods.

"This will be a breeders' competition, controlled and managed absolutely by themselves through a committee of competitors elected from their own number by ballot. *The Daily Telegraph* will place £50 at the disposal of the committee to provide substantial cash prizes. We will receive the entries, and arrange for the election of the committee.

"In order to increase the educative influence of the competition, one function of the committee will be to gather, arrange, and issue the best possible advice upon the subjects of feeding and general management, so that competitors and others interested in the work may be assisted in their efforts to attain the best results, and help forward the principal object in view—the improvement of the quality of the table poultry supply.

"Those who wish to compete with cockerels, capons, or ducklings, are asked to send in their names at once, together with the breed or breeds they wish to enter, to the Secretary, Table Poultry Competition, *The Daily Telegraph* Office. From the first twenty names received a provisional committee will be selected, who will meet during the coming week and arrange on what conditions entries will be formally accepted. When the entries are completed, the competitors will elect a committee of management from their own number by ballot.

"Upon receipt of all the entries, they will be classified according to various groups of breeds, so as to give every competitor a fair chance of showing what he or she can do with the breed of their choice.

"To briefly outline the competition, those who enter will be called upon to provide twenty birds for each entry. The twenty birds must be of the same breeding, so as to fill an export crate with birds uniform in size, and also in colour of legs and skin. At a given date, probably in February next, they will be sent to the Government Export Depôt, and there killed and dressed. They will then be judged for weight, appearance, and other table points. Following this, they will be publicly displayed in some central room in the city, and subsequently shipped to London, where they will be sold, and the net proceeds returned to the competitor."

Shortly after the above appeared, a number of breeders notified their intention of competing, and in due course a committee from the competitors was selected, and regulations provided for the numerous issues of the competition. Each entry was to consist of twenty birds, and to be as uniform as possible, to be reared by the competitor, and approximately five months old, and not to show any spur. The grader being in power to reject any not up to the standard, and to be judged by a scale of points, and to be shipped to London as soon after preparation as possible, to be sold there by an approved agent. There were classes provided so that every breed could compete, including Leghorns, a breed which no one ever contemplates as suitable for a local trade, much less an export one. However, as this breed, and one or two others, had not previously been exported, all were to have a show. One matter should be mentioned here. The provision was for cockerels only, and when inquiry was made as to the exclusion of pullets, the sound commercial reason was given that "we require the pullets for laying; it pays us better to keep them." This brings about the question whether the motive of the competition was the encouragement of better table poultry for our own markets, or an attempt to re-establish an export trade with England. If the former, then there is a market for cockerels here; but if an English trade is desired, then it is rather a selfish spirit, and it will never do to send to that country just what we do not require or wish out of the way; rather we must send to England the very best we have,

and the best is not too good. Cockerels are never so meaty as pullets. The latter, at eleven to fourteen weeks old, if well fed, are plump, and in England will be sold as prime spring chickens, while cockerels of every breed, Game excepted, are usually thin of flesh and bony. In connection with our great

Powell and Gough's Champion Ducks.

mutton export trade, it would well pay some of our poultry men to visit any of the great grading depôts and see the severity exercised in classing these goods; the slightest stain or spot, even on the best carcass, makes it a reject, while

First and Champion Prizes—Buff Orpingtons.

second and third rate sorts are put on our own market. An English trade is cultivated by supplying the very best quality of the sort and sex they require.

During the progress of the rearing operations, a number of those who had previously entered, from one cause or another, withdrew from the competition, with the result that of the sixteen or seventeen hundred head originally entered, about half that number were presented at the depôt, a change in the meantime to cases containing twelve birds, from the original twenty,

First Prize—Black Orpingtons.

being in breeder's favour. Whether it be a matter for regret or congratulation, the larger portion of the poultry contributors were fanciers, the ordinary poultry man, as usual at poultry competitions, standing aloof. Excepting Mr. Ellis, and another one or two, none had any previous experience

Second Prize—Black Orpingtons.

in exporting, and more than one breeder had never heard of an export depôt, or that many thousands of fowls were being annually exported. This feature was evident from the morning of the first arrival at the depôt, it being at once seen that some of the competitors considered size the one desideratum, and, to secure that end, the stipulated age was exceeded by two or three months.

Indeed, I quite agree with Mr. Hart, who judged the birds, that some of them were eight months of age, and, so far as a number of the Orpingtons were concerned, the combs, spurs, size, and general plumage would have qualified them for a breeding pen.

First Prize—Capons.

That this size theory for table poultry for England still obtains is inexplicable, seeing that in all the Department's regulations and other poultry literature, breeders are informed that for a payable export trade the birds

Second Prize—Capons.

must be young. Not more than a year ago large numbers of *Gazette* reprints on export poultry were issued, from which the following is an extract:—"I may state that, whatever the dimensions of the forthcoming poultry export be, such can only be shipped with a profitable prospect during January,

February, March, and early April. In these months, young chickens are always scarce in London, while it is just the season that they are most plentiful

Case showing the long spurs.

here. In January, 2½ to 3 lb. birds, if plump, are quite large enough, and are known in London as "spring chickens"; by February, 3 lb. to 3½ lb.

Sent to Depot for export to England.

birds will do best, and, like the others, will have no competition in London with Americans. From May on, large specimens, such as the Americans,

but less meaty, are available here, but it will be found that local marketing for such will be the more profitable."

Throughout the preparation of the goods, which extended from the 7th February to the 23rd, it was at once evident that a number of the competitors had small knowledge of breeding table fowls to secure the best results in either the local or export markets, and, anticipating reflections on some of the birds, I took copious notes of the various defects, these notes forming the basis of a report which I forwarded to the Department, and showing that although some lots were not in accordance with the Department's regulations, and individual specimens unavoidably objectionable, and that all the Department's responsibility was the preparation, it would be a good thing for all to be shipped, just to get an opinion on the various sorts. My report was duly forwarded to the Agent-General in London, whose produce inspector made daily visits to the selling agent throughout the time of their disposal. The inspector's report is appended, and bears out almost to the letter the salient features of my remarks, as does the selling agent's criticisms to the *Daily Telegraph*, their exhaustive report being confirmatory of the Committee's selection of an agent who would justly account for the contents of every case.

Chapter IV.

This Year's Shipment.

The following Interim Report on poultry, *ex* s.s. "Damascus," has been received by the Minister for Mines and Agriculture from the Agent-General in London:—

"I reported last week that the transport condition of the fifty-one cases of poultry shipped in the 'Damascus' was excellent, and I beg to confirm this.

"I have paid several visits during the week to Messrs. Edwards and Walkden, the salesmen entrusted with the sale of the poultry, who have given me all the information in their power.

"In the matter of packing, it is hardly possible to find fault, the highest praise being given to the style of box, the method of packing in blotting-paper, and the way in which the fowls and ducks are laid in the boxes. The only criticisms offered are that the total weight of the birds should be stencilled on the ends instead of the sides, and that it is not necessary to fasten the legs of the chickens together with string. Also, for the large birds some of the boxes were too small.

"With regard to quality, the Buff Orpington cockerels are, of all those hitherto inspected, by far the most suitable for this market, and it is to be regretted that there are so few crates of this breed of fowl in the shipment.

"The Black Orpington cockerels and capons are of fair quality, and the birds are of good size, so far as I have inspected them. The great fault found with them, and it is a serious one on this market, is the

colour of the legs. It is, of course, simply a matter of prejudice; but buyers here prefer white-legged and white-fleshed fowls, and where possible they will avoid all dark-coloured birds.

"Case No. 1 (Black Orpington cockerels) had a large number of backs badly bruised, and though the skin did not appear to be broken, they were most unsightly on account of the extravasation of blood beneath. The dealers professed themselves as quite unable to account for this.

"The White Leghorn capons and fowls, although the colour was satisfactory and the birds were young, are most unfortunate in being the possessors of huge spurs. This is fatal to their chances on this market of fetching the best prices. Every cookery book tells the housewife that large spurs are an unfailing sign of age, and buyers say they cannot spend their time trying to undermine what, with the average housewife, is an article of faith.

"The pullets, of which there was only one case—a matter of regret—have been favourably commented upon, and the salesmen inform me that there is quite a good market for these. They estimate the present crate to fetch 2s. 1½d. per bird net, a very good price.

"Surprise was expressed that no Plymouth Rocks had been sent. This breed is very popular here, and is sent in large quantities from America. I was shown a crate of these birds weighing nearly 6 lb. apiece, of a good colour, and with very small spurs. The appearance of this crate created a very favourable impression on my mind.

"The Aylesbury-Pekin ducks were highly praised for colour, size, condition, and quality, and were greatly superior in all respects to the Buff Orpingtons, concerning which breed the criticism was decidedly adverse. The Aylesbury ducks are estimated to fetch about 3s. to 3s. 6d. each, and the 'Buff Orpingtons' from 2s. to 2s. 6d. each. The fowls will produce, it is thought, from 2s. 3d. to 3s. each. It must be understood that these prices are only estimated at present, and in a further report I shall be able to go more exactly into this matter.

"In plucking ducks for export, it will be advisable in the future not to remove the down from the wings and the back, as doing this renders the birds more unsightly when thawed out.

"The ducks arrived somewhat too late to find the best market in this country. They should be sent off to arrive here between January and April, when they would have the field practically to themselves.

"I hope next week to send a final report on the other breeds which have not yet been inspected or sold."

The reports on meat and poultry are furnished to the Agent-General by a thoroughly qualified expert.

Taking the remarks seriatim:—

1. Packing.—"Hardly possible to find fault—highest praise given to the box methods of packing, &c." I have only just to remark that the goods were packed and handled, as were the thousands of others sent to London some years ago, when the same fulsome praise was given.

Regarding the approved blotting-paper, such is not used in packing for South Africa, and involves a loss of about 4d. per case to the Department. The agents say it is not necessary to tie the legs down. I have to remark that this simple method vastly improves the appearance of the birds by showing up the full breast, and pressing the meat to top. The illustrations in this article show the meaty breast appearance of the Australian birds as against the Americans, where the legs are allowed to cover the breast; further than this, at the end of last year an American journal sent a poultry expert to England's greatest table-poultry show to find out if there were any secrets in the preparation and display of table fowls. In his report of the winning birds, he says they were long and sufficiently fat to make a well-formed body; the legs were tied down by a string just below the hocks, and passed round the body; the toes were tied near the ends and close to where they joined the feet, and this string was passed underneath the back, and the wings were tucked backward underneath the back. The following is the report on the first-prize winners at the Dairy Show:—"The birds are modelled ovals, and by the tying-down process their plumpness was emphasised." The above is exactly how and why all our poultry are and have been handled at the Export Depôt for the past eight or nine years, and with such testimony to the methods there is no reason for a change.

2. The Buff Orpington cockerels are described as the most suitable for the market. At the same time, the yellow-legged Wyandottes brought 2d. each more than those highly spoken of.

3. Black Orpingtons are described as faulty, on account of the leg colour. This is admitted, but whether the breeders of those shipped to London continue or not to ship, they will continue to breed Black Orpingtons.

4. "One case with the backs bruised."—This is solely due to the birds trampling each other during transit to the depôt, whether by road or rail. The backs of young birds are charged with blood to supply the growing pin-feathers. The slightest injury causes this blood to flow, and in the process of freezing the back becomes discoloured; any injury after the bird is killed—such as a tear when plucking—the blood does not appear. As showing the injuries inseparable from the transit of poultry, I should say that in this small shipment three birds arrived in the coops dead, trampled to death, while of twenty-four Silver Wyandotte cockerels sent by Mr. Bracey, of Jesmond, my book shows that nine of them were so much injured that they could not be shipped, consequently this breeder suffered to the extent of a case, a whole dozen having to be disposed of as rejects. Visitors to the Export Depôt on show day will recollect the unsightly bench of rejects, the backs of some of the specimens being perfectly black. One of the greatest worries to the Sydney poultry-salesmen is that of acquainting their clients of the deaths in the weekly consignments, almost every breeder having experience of these losses.

5. "Capons and fowls having long spurs."—This is quite true, and dealt with some time ago, but will be treated in a future article. One thing was evident. Quite a number of birds sent in as capons were not so, having evidently been operated on too young.

6. "Regret expressed that there was only one case of pullets."—I have previously stated that there was no class for this sex. However, Mr. Ellis, being short of an entry, and knowing the London market well, sent a dozen of these, about 10 or 11 weeks old, and their reception was just what he and I expected. They weighed but $2\frac{3}{4}$ lb. each, and fetched 4s. 3d. per pair, a higher price than a number of the older and heavier cockerels. In connection with the exporting of such birds as the above, there is a good market for them in the early months of the year, and being small the expenses will not reach more than 1s. per pair, as against 2s. 6d. for the larger birds.

7. "Surprise expressed at no Plymouth Rocks being sent."—There is no surprise here; this breed is now almost extinct in Australia.

8. The report of the ducks is just as I expected, and is no more flattering than that received some years ago on thousands shipped by Mr. Ellis and other breeders. The report again shows that those who can only send in a dozen birds are considerably handicapped. There were just as good specimens in those forwarded by Messrs. Moss and Brown as were Gough and Powell's champions; but then there were some third-rate quality amongst the dozen which brought down the price; whereas Gough and Powell had forty-eight birds, with the result that the twelve best were selected, which returned him 5s. 9d. per pair, being a shilling more than those they were selected from, and this feature will always obtain in the matter of exporting. The man who has only a dozen or two of birds can never export them profitably, for no matter how good they appear when dressed, there will be faulty specimens, consequently they must go ungraded or be rejected altogether. In coloured ducks the criticism was adverse. This, however, was expected. White ducks always look best when dressed. At the same time, colour is only one issue, feed and management, as will be seen by the report, being the decisive points in value. The coloured returned 3s. 3d., 3s. 6d., and 3s. 7d. per pair, whereas a case of Pekins returned but 3s. 2d., the lowest in the consignment. Reverting to the preparation of the ducks, the Inspector's report says that "In future it will be inadvisable to remove the down from the wings and back, as this renders the bird more unsightly when thawed out." On this subject, not many months ago, a gentleman informed me he was told the reason our ducks did not sell well in London was that their wings were not plucked. He was politely informed that our ducks always did sell well, and that while Australian meat—beef and mutton—does not fetch half as much per lb. as do English, that our poultry, when good, always fetch full English prices. However, the above is just to show the diverse advice one gets; but coming to the bed-rock of business: If duck-breeders send Home goods that returns them Mr. Powell's price

of 5s. 9d. per pair, they will not dispute whether the journey to England was made in full dress or undress, or, in the Department's usual way, simply dressed.

In the final report from the Agent-General, the Wyandottes are reported as good; Faverolles not spoken highly of; cross-bred poor, and Leghorns realising a poor price. Faverolles were a very irregular mixed lot, and averaged but 3¾ lb.; still, they fetched the same price as Orpingtons of the same weight. I think the above traverses the whole report, except that of grading, which, as the report says, for an export trade must be done. This we all know, but the newer breeders do not; consequently, whether in relation to future experiments of the *Telegraph* or a continuance of exports by the people who have experimented, consignments should at least consist of forty birds. From this number a couple of cases could be selected, and the balance sold locally. An illustration will suffice. Some two years ago, Mr. Lance, then Commercial Agent, sent to the depôt here a case of Chicago fowls for examination by our breeders. The following will show how closely they are graded as to weight in that country. The individual weights of the fowls were as follows:—3 lb. 15 oz.; 3 lb. 9 oz.; 3 lb. 8 oz.; 3 lb. 14 oz.; 3 lb. 9 oz.; 3 lb. 10 oz.; 3 lb. 12 oz.; 4 lb. 3 oz.; 3 lb. 14 oz.; 3 lb. 10 oz.; 3 lb. 7 oz.; 3 lb. 9 oz.; or a total of 44 lb. 8 oz.; or slightly over 3¾ lb. each.

The disparity in size of some of those in the *Daily Telegraph* consignment will be realised by the following weights of a case of Black Orpington cockerels:—6 lb. 5 oz.; 5 lb. 3 oz.; 4 lb. 12 oz.; 5 lb. 4 oz.; 5 lb. 8 oz.; 5 lb. 12 oz.; 7 lb. 1 oz.; 6 lb. 6 oz.; 5 lb. 4 oz.; 5 lb. 12 oz.; 5 lb. 6 oz.; 5 lb. 12 oz. Here is a difference of over 2¼ lb. in the weight of individual birds in the same case. Another illustration will suffice:—7 lb. 4 oz.; 6 lb. 12 oz.; 6 lb. 8 oz.; 6 lb. 8 oz.; 5 lb. 12 oz.; 5 lb. 13 oz.; 5 lb. 13 oz.; 5 lb. 12 oz.; 6 lb.; 5 lb. 8 oz.; 5 lb. 8 oz.; 5 lb. 3 oz.; a difference of 1½ lb. Further, this breeder had sent in eighteen birds, but the above was the best grade that could be made, the rejects weighing as low as 4 lb. 12 oz, and as high as 7 lb. 8 oz., almost a difference of 3 lb. in a consignment to make up a dozen.

The above should be sufficient to show that small lots will always be handicapped through want of sufficient numbers to select from.

Chapter V.

Selling Agents' Report.

Coming to the report forwarded by the selling agents to the *Daily Telegraph*, such is exhaustive enough for all purposes. Every case is referred to, and largely confirmatory, but more particularised than that from the Agent-General. The only thing difficult to reconcile is, wherein some cases are described as just suitable for the London markets, such realised no more than the lots which failed to receive favourable comments.

Appended are the detailed particulars from the *Daily Telegraph*:—

No. of Crate.	Competitor, Address, Breed.	Average Weight.	Points Scored. Size.	Quantity of Breast Meat.	Straightness of Keel.	Fineness of Bone.	General Evenness in Appearance.	Colour of Skin.	Total.	Price, Each. s.	d.	Net per Pair. s.	d.
	Possible points	.	15	40	10	10	15	10	100				
	Class 1.—Cockerels.	lb.								s.	d.	s.	d.
5	J. Ahern, Arncliffe: Black Orpingtons	5½	11	40	10	10	14	9	94	3	9	6	3
6	W. Frame, Canterbury: Black Orpingtons	5¼	11	40	5	5	12	9	82	3	8	6	1
8	Griffiths Bros., French's Forest: Black Orpingtons	6	12	30	8	10	10	8	78	4	0	6	9
3	Grantham Poultry Farm, Plumpton, Black Orpingtons.	6¼	12	35	9	2	10	8	76	3	7½	6	0
7	W. Frame, Canterbury: Black Orpingtons	5	10	30	4	10	10	7	71	3	6	5	9
15	W. T. Ely, Rydalmere: Black Orpingtons	5¼	10	26	8	8	10	8	70	3	0	4	9
14	E. Waldron, Willoughby: Black Orpingtons	4½	9	26	8	8	10	8	69	2	9	4	3
13	S. Ellis, Botany: Black Orpingtons (pullets)	2¾	5	25	9	10	12	8	69	2	1½	3	0
4	Grantham Poultry Farm, Plumpton: Black Orpingtons.	5¼	10	28	7	9	8	6	68	2	9	4	3
12	J. Payer, Ryde: Black Orpingtons	4½	9	28	8	7	8	7	67	2	9	4	3
16	W. T. Ely, Rydalmere: Black Orpingtons	4¼	8	24	6	8	8	7	61	2	7½	4	0
1	J. Stewart, Berowra: Black Orpingtons	4½	9	25	8	8	7	4	61	2	3	3	3
17	W. T. Ely, Rydalmere: Black Orpingtons	3¼	6	20	5	8	10	6	55	2	0	2	9
2	J. Stewart, Berowra: Black Orpingtons	4¼	8	20	5	8	5	6	52	2	3	3	3
9	L. L. Ramsay, Carlingford: Black Orpingtons	3¾	7	20	5	7	5	6	50	2	4½	3	6
	Class 2.—Capons.												
19	W. T. Ely, Rydalmere: Black Orpingtons	6	12	38	8	9	15	10	92	4	0	6	9
18	S. Ellis, Botany: Black Orpingtons	4½	9	25	6	9	8	5	62	3	0	4	0
	Class 3.—Cockerels.												
20	Grantham Poultry Farm, Plumpton: Buff Orpingtons.	5¼	11	40	9	10	15	10	95	3	9	6	3
21	Grantham Poultry Farm, Plumpton: Buff Orpingtons.	4½	9	30	9	9	12	10	79	3	0	4	9
24	P. A. Buckhorn, Albury: Buff Orpingtons	4½	8	20	9	7	10	10	64	2	10½	4	6
22	J. McComb, Manly: Faverolles	3¾	7	22	8	9	7	9	62	2	4½	3	6
25	Hawkesbury Agricultural College: Buff Orpingtons	3¾	7	18	10	6	5	8	54	2	7½	4	0
	Class 4.—Cockerels.												
28	R. Bracey, Jesmond: Silver Wyandottes	4½	9	30	8	10	12	10	79	3	2	5	1
27	R. N. Strode, Castle Hill: White Wyandottes	4	8	28	9	9	10	8	72	2	9	4	3
26	R. N. Strode, Castle Hill: Silver Wyandottes	4¼	8	28	9	9	10	6	70	2	8	4	1
	Class 5.—Capons.												
29	Grantham Poultry Farm, Plumpton: Wyandottes	5	10	33	9	8	12	9	81	3	3	5	3
	Class 6.—Cockerels.												
30	F. J. Brierley, Carlingford: White Leghorns	3¾	7	30	10	9	12	8	76	2	4½	3	6
31	F. J. Brierley, Carlingford: White Leghorns	3¼	6	25	10	9	10	7	67	2	0	2	9
32	H. Carney, Kingswood: White Leghorns	2¾	5	20	9	9	9	8	60	1	10½	2	6
	Class 7.—Capons.												
37	F. J. Brierley, Carlingford: White Leghorns	4¾	9	35	10	9	1	8	85	2	6	3	9
38	F. J. Brierley, Carlingford: White Leghorns	4½	9	30	10	9	1	7	77	2	4½	3	6
39	S. Ellis, Botany: White Leghorns	4	8	28	9	9	12	8	74	2	3	3	3
40	S. Ellis, Botany: White Leghorns	4	8	26	8	9	11	7	69	2	3	3	3
35	J. Stewart, Berowra: White Leghorns	4	8	28	0	9	1	8	66	2	6	3	9
36	J. Stewart, Berowra: White Leghorns	3¼	6	24	0	9	12	8	59	2	3	3	3
41	S. Ellis, Botany: White Leghorns	2¾	5	18	9	9	7	7	55	1	9	2	8
	Class 8.—Cross-bred Cockerels.												
45	J. E. Dodds, Colyton: Indian Game x Wyandotte	4	8	30	10	9	12	9	78	2	9	4	3
44	Mrs. S. A. M. Carter, Smithfield: Houdan x Brahma	3½	7	26	10	7	11	8	69	2	0	2	9
43	Mrs. S. A. M. Carter, Smithfield: Houdan x Brahma	4½	9	20	9	6	9	6	59	2	0	2	9
	Class 9.—White Ducklings.												
46	Gough and Powell, Alexandria: Aylesbury x Pekin	5¾	10	40	10	10	20	9	99	3	6	5	9
48	Gough and Powell, Alexandria: Aylesbury x Pekin	5¼	10	35	9	10	20	10	97	3	0	4	9
47	Gough and Powell, Alexandria: Aylesbury x Pekin	5½	10	39	8	10	20	8	95	3	0	4	9
49	Gough and Powell, Alexandria: Aylesbury x Pekin	4¾	9	35	8	10	18	9	89	3	0	4	9
51	G. Moss, North Botany: Pekin	4¾	9	36	8	10	15	8	86	3	0	4	0
50	W. Brown, Botany: Pekin	4¾	9	35	8	10	15	8	85	2	10½	4	6
58	S. Ellis, Botany: Aylesbury and Pekin	3¾	7	25	4	10	12	7	65	2	6	3	9
59	S. Ellis, Botany: Aylesbury x Pekin	3¼	7	25	5	10	10	7	64	2	3	3	3
52	Hawkesbury Agricultural College: Pekin	3¾	7	15	7	10	4	7	47	2	2½	3	2
	Class 10.—Coloured Ducklings.												
63	S. Ellis, Botany: Buff Orpington x Pekin	3¾	7	28	7	10	15	5	72	2	4½	3	6
60	E. Armstrong, Dapto: Buff Orpington	3¾	7	25	8	10	13	5	68	2	6	3	7
57	S. Ellis, Botany: Buff Orpington x Pekin	3½	7	25	8	10	10	6	66	2	3	3	3

The above tabulated statement tells a good deal, but there are many important points not brought out, and which, in the interest of breeders who purpose exporting, should be made known. Perhaps the chief of these is in relation to grading, and here it may be said, that those people who send but a dozen, or even fifteen fowls from which to select a dozen, grading is impossible. The best twelve of the fifteen may be selected; but in this dozen, a single carcass may be so objectionable as to injuriously affect the eleven good ones, and warrant a report from London as to bad grading, and of course the prices suffer accordingly. In relation to the above consignment, it need not be expected that in the future any London wholesale agent will go to the trouble of separating a box of a dozen fowls, and deal them out in two or three lots, to make the best of them, as was done by the London agent with several lots, notably case 25, where the birds were sold at 2s. 9d., 2s. 3d., and 2s. In this instance, there was one bird in the case but 3 lb. weight, another 3 lb. 2 oz., while a couple went as high as 5 lb. 10 oz. Not a bit of wonder the agents say grading should be done. Had grading been done here, all would have been rejected, as each case had to contain a dozen, and there is not a doubt but had the complete case been sold as the wholesale agents do—complete—they would not have averaged more than 3s. 6d. a pair, rather than 4s.

The same circumstance obtains with case 29—Capons. Six sold at 3s. 6d. and six at 3s., the weights being as low as 3 lb. 12 oz. and as high as 6 lb. Many other like instances occurred in the small shipment.

After the detracting reference to the Leghorn consignment, it is scarcely likely that any will be again offered; but should there be, I will here say, in all seriousness, that spurred birds will be rejected.

It can be correctly retorted that provision was made in the regulations that there should be no spurs showing. This certainly is a fact; but had this, and the Department's regulations as well, been carried out to the letter, there would have been a very small consignment.

However, should the experiment be repeated, my instructions are that the regulations as to grading must be carried out, and to that end consignments of greater quantity must be provided, otherwise the man who sends in a dozen fowls, with but one objectionable, will find his entire lot rejected. This is an apparent hardship, for the reason that in some instances objectionable features of a serious nature are not observable till after the birds are killed and plucked.

The next feature is that of "bruised on back," as reported by both the Agent-General and selling agents. This obtained in quite a number of the birds, and always will when they have to be conveyed considerable distances. They trample over each other, bleed, and become unsightly. No. 2 case, the report says, "Skin broken on breast." This was the result of where a growth was removed, as shown by packing-book. Mr. Bracey's birds suffered terribly through travelling. A very excellent lot of twenty-four Wyandottes were forwarded; two or three arrived dying,

and about half a dozen having their backs in a state of raw flesh. Mr. Bracey in his letter refers to this matter, and says, "The ordinary railway coop was too low, and he got a turkey coop to carry them in." This is just where the trouble may have arisen. These coops are constructed to the requirements of carrying, and had the low coop been used, there would not have been so many birds injured. Through this cause, the breeder was only able to ship one case.

The report refers to Nos. 4 and 6 as, "Skin rubbed off breast and thighs by case too small." This is, again, a matter of the small consignments. Special cases were made for some of the largest birds, but this was not one of them. One bird was as low as 4 lb. 12 oz., the entire lot averaging 5¼ lb.; still, there was a 6 lb. bird in the case. Had the special case been used, the birds would have only partially filled it, and on the journey would have been rolling about like bullets in the box. Case 6 was a specially-made case; but here, again, the same irregularity occurred. The specimens, although averaging 5½ lb., ran up to 7 lb. 2 oz. The latter, and one or two others approaching that size, naturally would be bruised, while the 5 lb. birds would also be liable to damage, through having too much space.

One other and important matter should be mentioned. Nothing affects the appearance of frozen poultry as the defrosting and refreezing; the bloom goes off the carcase, they become flabby and soft, and attract the dust. During the time the birds are on view, this obtained with the consignment under notice, and in more than one instance birds were disturbed in their position in the case, and in this half-hard state had to be crushed back into their place, and afterwards nailed up, all tending to the rubbed skin mentioned in report. In any future competition, the birds should not be exposed more than, say, half an hour on either judging day or show day; and in other products, those in charge of such would not allow any removal from freezing chambers till shipment.

Chapter VI.

Local *v.* Export Marketing.

It requires no demonstration to assure us that there is a market in London for good poultry; such has been proved over and over again. The writer's belief, however, is that such is only payable in the early months of the year, and in seasons when our poultry foods here are normal. In such times amongst our very poor class of table poultry there are always a quantity of good ones which can profitably be shipped to London. This was done in the past, and just as sure as our poultry foods get low, and continue so for two or three years, our stock will increase beyond local demands, and, like our meat and wheat in plentiful years, they will flow to London. I believe that our local markets here

have not been reached within the past few years with good quality fowls, much less with London quality, and realising the past year's dear poultry foods, and the handicaps to London of 1s. 3d. to 1s. 6d. per pair, and the further loss on rejects, I feared my convictions were the correct ones in relation to the consignment under notice, and having but the one desire of placing every pro and con of the situation before breeders, I received authority to post the following circular to all those who were represented in the late consignment:—

Cold Storage Depôt, Pyrmont, 27 June, 1906.

Sir,—The Agricultural Department having received a report from the Agent-General in London on the *Daily Telegraph* consignment of poultry to that country, have requested me to write an article for the *Agricultural Gazette* on the subject, and, as you were one of the shippers, I will thank you to briefly give me your experience of the matter from the paying point of view, and apart from the prize-money, which was a considerable feature in the shipment. I think the chief points would be: Can you rear the birds to the age of those shipped to pay you at the net price returned for same, and was this price more or less than that received for same weight and quality marketed by you in Sydney?

Yours, &c.,
G. BRADSHAW.

Mr. W. T. Ely was the first to reply, as follows:—

"I am strongly of the opinion that the *Daily Telegraph* consignment of poultry has not only shown us what not to do, but has paved the way to a successful solution of that much-vexed question, the marketing of our surplus stock with profit to the breeder. I have never been able to profitably rear table poultry for the open market here, and until the *Daily Telegraph* suggested caponising I had decided to kill all cockerels as soon as I discovered the sex. The result of caponising astonished me. Fed on the same mixtures, the capons developed rapidly, and, if anything, ate less than the cockerels, which was due to the latter displaying more activity. My best crate of cockerels averaged 5¼ lb., and realised net 4s. 9d. per pair, while my capons topped the market, the average weight being 6 lb., and realised net 6s. 9d. per pair. There was three weeks difference in age, in favour of the capons, but that would not account for anything like the extra 2s. per pair. I consider 6d. per lb., even at the high price of feed, pays me well, and I have never received that for equal stuff in the local open market."

Mr. Ely makes a slight mistake when stating that his 6 lb. capons topped the market. Mr. Griffith's cockerels realised the same price, and the latter dozen weighed but 72 lb., as against the capon's 72 lb. 13 oz. Mr. Ely's cockerels returned net 4s. 9d., 4s., 2s. 9d. per pair, but no local prices are given as requested.

Mr. Dodd, who shipped twelve cross-breds, says:—

"I am satisfied with my results of 4s. 3d. per pair. Similar birds in Sydney auction sales fetched at the same time 3s. 9d. to 4s. 4d. per pair. These prices must not be confused with present rates, when 3¾ to 4 lb. live weight fetched 3s. 9d. to 3s. 10d. for 3½ to 4 months of age. Prices are not much better than could have been had here, but one has to take chances of the markets. I question if present rates can be maintained, good stuff now fetching 5s. 6d. to 6s. 6d. per pair. The birds did not cost me more than 1s. each to rear and fatten; they had a certain amount of skim milk, which is not charged."

The Grantham Poultry Farm, who sent a grand lot of birds, and won the champion prize for the best in consignment, writes:—

"We consider that each case left us a fair margin of profit. We would like to be sure of the same price for all we could raise in connection with the rearing of pullets. At the same time, we know we could have realised more for the first-prize birds at that time in Sydney—in fact, 6s. 8d. was given that day in Sydney for some not so good."

Mr. W. Frame, of Canterbury, who got second and fifth prizes, and was returned net 6s. 1d. and 5s. 9d. respectively, with 5½ and 5 lb. birds, says:—

"Neither the prize-money nor the price for the birds concerned me greatly. I wanted to know what the prospects in the London market were. Actually, I could have done as well or better by selling my birds locally, and unless a good difference could be shown in favour of London, it would not be worth while sending them there."

Mr. Buckhorn, an Albury orchardist and extensive poultry-breeder, who shipped a case of 4½ lb. Buff Orpingtons, and reported by the agent as very good, and which realised 4s. 6d. net per pair, says:—

"The prices quoted are not very tempting. I have got as much as 5s. 11d. per pair for cockerels in the Sydney markets. The people who sold the chickens may be very big people in business, but that does not say that others could not do better. I should favour a representative in the exporters' interests to give a report on the spot."

Mr. Bracey, of Jesmond, forwarded to the depôt thirty-nine good Silver Wyandottes, but owing to a number of them being trampled on during the journey only one dozen could be shipped. They were described by the agents as very good, and realised 5s. 1d. net per pair. Mr. Bracey writes:—

"I cannot say what it cost to rear the birds; at any rate, we cannot get pullets without the cockerels, which have to be got rid of somehow. If I had put them in the market I would have got about 4s., so I am well satisfied with those sold in London; but with the sale of the rejects, the price will be between 3s. and 4s. per pair."

Mr. Bracey complains about the damage by rail, which is referred to in another portion of this article.

Mr. Ahearn, who won first in the class and received 3s. 1½d. each for 5½ lb. birds, says:—

"The prices here are rather poor from Christmas. I am satisfied other markets are required to relieve ours. My birds would have fetched about 4s. 6d. the pair here. There being an equal number of cockerels bred as pullets, London will be a splendid place to sell them. I am breeding Buff Orpingtons for next competition, and will also ship pullets, as they fatten quicker."

Mr. James Stewart replied as follows:—

"I have always held the opinion that a good market was available in London for Australian frozen poultry, and when the initial difficulties have been overcome, and the business of exporting put on a sound basis, I fail to see any reason why it should not be a real good thing for the Australian poultry-man. As regards the *Daily Telegraph* consignment

of poultry, I consider that it has proved that when we export the right class of birds, there is a good and payable market. I am quite satisfied with the prices obtained for the birds I sent, and find that they were more than I was getting in Sydney at the same time."

Mr. H. Carney, of Kingswood, writes:—

"I regret to say that, as far as my birds are concerned, it was far from being a success. The net returns are not sufficient to pay for rearing them. But I attribute that to the class of poultry I went in for. I may mention that I sent a consignment to Sydney agents at the same time as I sent those for export, and they realised 3s. 3d., and were the rejected birds from the exported ones. From this, I estimate that my birds, if sold in Sydney, would have brought 3s. 6d. per pair."

Mr. Brierly, "Wytona," Carlingford, writes:—

"As regards the paying part of fowls shipped by me, I have no hesitation in saying that they were a failure, and, without exaggeration, I could have netted half as much again at Mr. C. J. Turner's rooms. I could not profitably rear birds to the age my capons were (7 to 9 months), but with regard to the cockerels, which were 5 months old, the price obtained shows a profit. The main question (as regards my consignment) is whether I could have done better in Sydney—the answer is, yes."

The above are all the communications to hand at time of writing, and represent those who got big prices, and the lowest as well.

It will be seen some of them considered the export business as something new, others that it is a good way to get rid of the surplus cockerels.

As previously remarked, the majority of the shippers were not the usual market poultry-men, and only in one or two instances have they been able to give local quotations. Realising that such would be the case, simultaneously with sending the requests as to results, I addressed the following to the four city poultry salesmen:—

I have been requested to contribute an article to the *Gazette* on the late table poultry shipment to London. Its results, in comparison with local marketing, will be better seen if you could favour me with your best monthly prices for the past twelve months. Adding, that the name of the firms would not be mentioned except desired.

Following are the replies:—

Haymarket, 5 July, 1906.

Sir,—Replying to your favour of the 27th ultimo, I have pleasure in forwarding herewith list of the top prices obtained by me between May, 1905, and May, 1906, to guide you in the matter you purpose writing for the *Agricultural Gazette*. Although these are the top prices realised in the months stated, I think it is only fair to point out that these figures were much more frequent during the months of August to March, inclusive; while for the months of June, July, April, and May they were exceptional prices, and not so frequent as in the other months. Further than this, I feel that it should not be lost sight of these birds were sent in in the ordinary course of business, many of them coming to me by steamer, thus not having the benefit of the special conditions that birds prepared for a prize test for export would undergo. I frequently recommend my consignors to push on the growth of their cockerels, and market them at four to five months' old, at most, instead of holding them for two or three months longer for the slight advance in the price. I am fully impressed that our market demand is not so much for a large bird as for a medium-size plump bird of a tender age. You are at liberty to make use of my name in your report should you think fit.

Yours, &c.,

C. J. TURNER.

The Poultry Farmers' Exchange.

LIST of Prices, as advised per letter of even date.

1905.	s. d.	s. d.	s. d.	s. d.	1906.	s. d.	s. d.	s. d.	s. d.
June ...	5 6	5 3	5 0	4 11	Jan. ...	6 9	6 6	6 0	5 8
July ...	6 3	5 6	5 4	5 3	Feb. ...	6 9	6 6	6 5	6 4
Aug. ...	6 6	6 1	6 0	5 9	March ...	6 9	6 6	6 3	6 0
Sept. ...	8 0	6 7	6 6	6 0	April ...	6 11	6 10	6 7	6 4
Oct. ...	6 9	6 7	6 4	6 2	May ...	7 3	6 9	6 3	5 9
Nov. ...	7 0	6 11	6 9	6 7					
Dec. ...	7 9	7 4	7 0	6 11					

Sydney, 4 July, 1906.

Sir,—In reply to yours of the 27th instant, attached you will find information required. We might also inform you that we so rarely get sales of English ducks (Aylesbury, Pekin, &c.) that we could not report to you anything reliable. You have our permission to insert the firm's name in your article.

Yours, &c.,
ELLIS & CO.,
Poultry, &c., Salesmen.

HIGHEST Prices realised at our Sales.

1905.		s. d.	1906.		s. d.
May ...	Fowls (Roosters)	5 6	Jan. ...	Fowls (Roosters)	7 6
June ...	,,	5 10	Feb ...	,,	6 11
July ...	,,	6 6	March ...	,,	6 5
Aug. ...	,,	6 8	April ...	,,	6 3
Sept. ...	,,	5 8	May ...	,,	7 4
Oct. ...	,,	7 6			
Nov. ...	,,	6 6			
Dec. ...	,,	7 6			

Sydney, 2 July, 1906.

Sir,—In accordance with your request, I have pleasure in forwarding a list of highest prices obtained for cockerels and English ducks at our weekly sales. We held no sales prior to October, and consequently cannot get behind that date. It should also be remembered that for the space of at least three months our prices were adversely affected by the buyers carrying on a boycott. I have put down the figures for each consecutive week.

Yours, &c.,
THOS. REID,
The Poultry Farmers' Co-operative Society, Limited.

EXTRACTED from Weekly Sale-sheets.

Date.	Cockerels.					English Ducks.			
1905.	s. d.	s. d.	s. d.	s. d.		s. d.	s. d.	s. d.	s. d.
October ...	4 10	5 0	5 7	5 9	...	2 9	2 10	3 0	3 3
November ...	5 11	6 9	6 4	6 0	...	3 0	3 11	3 10	3 4
December ...	6 3	6 5	6 10	7 6	...	3 6	3 11	3 10	5 4
1906.									
January ...	6 2	4 9	6 0	5 9	...	3 11	4 5	3 9	3 7
February ...	6 9	5 7	6 5	..	..	3 1	2 8	3 4	...
March ...	5 3	6 1	6 0	5 10	...	3 1	2 10	2 10	3 0
April ...	5 3	5 6	5 5	5 8	...	3 7	3 7	4 0	3 10
May	6 0	5 9	6 1	5 6	...	4 4	3 9	5 6	4 3

Sydney, 9 July, 1906.

Sir,—In reply to yours, I have gone through my account sales journals with the following result, *re* best prices for fowls at auction from May, 1905, to May, 1906:—

1905.	s. d.	s. d.	s. d.	s. d.	1906.	s. d.	s. d.	s. d.
May ...	3 10	4 4	4 1	4 6	Jan. ...	5 9	6 9	7 6
June ...	4 10	5 0	5 1	5 2	Feb. ..	4 9	5 3	5 9
July ...	5 0	5 2	5 3	5 8	Mar. ...	5 0	5 6	6 3
Aug. ...	5 4	5 6	5 9	6 0	April.	5 6	6 3	6 7
Sept ...	5 10	5 11	6 2		May ...	5 9	6 3	6 6
Oct. ...	5 11	6 0	6 9					
Nov. ..	5 10	6 4	6 7					
Dec. ...	5 9	6 6	7 9					

Yours, &c.,
W. F. MURPHY,
R. T. Murphy and Company.

It will be noticed that the prices received by the various firms are all approximately the same, a 1d. or 2d. per pair only separating them. The request for monthly prices was not only supplied, but two of the firms give the weekly prices as well; and the request for best prices was certainly advisable, it being conceded that the best-quality birds offered in the weekly sales are nothing approaching the best eight or ten lots that appeared in the competition; indeed, one of the salesmen remarked that he never got any such birds for disposal. There is not here any desire to draw comparison between the two systems of marketing—Sydney and London—as each salesmen's report, like a certain brand of tea, speaks for itself; and, to be impartial, it should be mentioned that in local marketing, the prices received are remitted to the breeders the following week, while if the birds go to London there is a four months' wait for returns, not to mention the additional cost of preparation, freight, insurance, &c., all of which has to be defrayed before they leave Sydney. Of course, should the time again arrive when we have thousands to export, agencies will be established in Sydney, and advances made against documents, as is done with our wheat, butter, meat, &c., or agents may purchase here at so much per lb. live weight. However, the experience in Victoria in this respect has been anything but a success.

During the past year, Mr. Grayson, a large exporter in another meat product, purchased what ducklings he could secure at 6d. per lb. live weight, to be Government graded. Mr. Grayson went to London himself, and disposed of the birds to the best advantage, and before his return I was favoured with an account sale of the transaction. The ducklings realised from 3s. to 3s. 6d. each, but there was no profit on the deal. The remark was also made, "That there was nothing in the business unless the goods could be procured at 5d. per lb." During January of the present year, this amount was offered; the sellers would not accept. The price was afterwards raised to 6d., and a few secured; but the bulk of those who had experimented this way the previous year preferred local marketing, as the rejected birds, which had to be sold at a sacrifice, brought the price below that obtaining in the Melbourne auction rooms.

Concerning the *Telegraph's* shipment of ducklings, one very choice case returned 5s. 9d. per pair net; the same owner's others 4s. 9d.; the latter were also excellent quality. Others returned from 4s. 6d. down to as low as 3s. 2d. per pair. Only one of the local agents supply the prices for English ducks, the prices during January and February being 3s. 11d., 4s. 5d., 3s. 9d., 3s. 7d., 3s. 1d., 2s. 8d., 3s. 4d. per pair, and it will be for breeders to determine which of the markets pay best. One thing is certain, in February and March choice quality of white ducks in England bring big prices.

CHAPTER VII.

Conclusions.

IT has been shown by the Sydney selling agents the excellent prices they received at every sale throughout the year; nor were the birds of such good quality as the bulk of those shipped. At the same time, several of the exporters say the English prices paid them the best. Under such circumstances there should be a continuance of the business, and this independent of the future competition, which is already announced. There is no doubt the prize money offered is a big inducement to export. At the same time, with the acknowledged paying part of the business, one condition should be that the competitors for the prizes should ship, say, 50 or 100 fowls, apart from the show or competition part of the business. This would be an earnest of the belief in the English markets.

Before concluding, it should be mentioned that through Press reports and other influences, there is a very prevalent belief here that Victoria has a great export trade to England; such is largely apocryphal. That State has had for now nearly twenty years a splendid propagandist in Mr. Hart, who is continually on the move in city and country preaching the doctrine of poultry exporting. For a shorter period there is a second expert—a lecturer, Mr. Hawkins—whose special business is to bring the poultry export trade before farmers and others. Still it will not go. Every year a few people export, the following year they will not touch it; but others are influenced Londonward. Again we hear of the good quality as against Sydney, the following being testimony that there is not much to learn here on the subject:—

"The following report from London agents on Victorian poultry exported to London has been handed to Mr. Crowe, the Victorian Superintendent of Exports. The birds were purchased at 6d. per lb. live weight in Melbourne, and dressed and frozen at the Victorian Government Cold Stores. The report is dated 20th April:—'Chickens.—A few cases of these came to hand this morning, and they are an undoubted improvement on last year's supplies. Some of the birds are splendid, and would meet with a great sale in London, whilst others in the same case are rather secondary and ill-conditioned. This must be avoided. Uniformity in size must be adhered to. For instance, if a case is marked "40 lb." all the chickens must weigh about 3¼ lb. This is how the aggregate should be made up, and not by packing six weighing 2½ lb. and six at 4 lb. Exactitude is a special feature with American packers, and in this way the retailer knows what he is buying. Perfection must be aimed at and obtained if the Australians are to get a hold on our poultry market. Chickens weighing 3 lb. to 4 lb. each sell best, and we are prepared to dispose of 5,000 cases next year if received at the proper time and in correct style and condition. Two crates of fowls were exceedingly good, but one was yellow; also one poor chicken in each crate of the good two. This is a foolish thing to do. Unless buyers can depend absolutely on the grading, they will not come up to the mark. The quality per crate must be uniform and above suspicion. You have greatly improved on last year. Ducklings.—We are glad to welcome the

manifest improvement in this year's shipments. We hope that the returns will be an incentive to a large expansion of the trade next season. Instead of 100 cases arriving this season, we should like to see ten times the number next. The standard of quality and weight should be kept well in view, and must not suffer deterioration. The packing cases are admirable in every way, and show off the birds to the best advantage. On the whole, we must compliment you on the general "get up" of the goods.'"

As will be seen from above, that after twenty years' advocacy, there is the same difficulty in getting a dozen chickens of equal merit, it being stated that there were in the same case good, secondary, and ill-conditioned; the report also tells what the breeders here have been told for the past eight or nine years, that 3 to 4 lb. chickens sell best in London, and when so they certainly pay best. The same compliment is paid to the get up of the goods as was done years ago, both here and in Victoria. There is no trouble in preparing the birds; it is a matter of getting them; and in the other States a like scarcity prevails, as will be seen from the *Garden and Field*, a South Australian paper, a portion of which is devoted to profitable poultry-keeping:—

"South Australia is a great country, for 900,000 square miles is her area. She is a great poultry-producing country, but whether she is at present quite the poultry man's paradise which some would have us believe is, I think, open to question. The writer does not wish to belittle the land of his adoption as is, unfortunately, a common but ungrateful practice. It will, however, do no harm, but rather good, to look the position in poultry work and prospects squarely in the face and examine for ourselves what basis there is for the frequently-expressed expectation of wonderful future development.

"The two great factors which control profit in any transaction are cost of production, to which must be added cost of marketing, on the one hand, and price received on the other.

"This is what the South Australian producer has to face, and it is just as well that he should know it. Of course, the question of a possible profit more directly affects the shipper, for all poultry export must be through a middleman until we reach the comparative millenium of co-operation, which is not yet, I am sorry to say.

"Let us now look to the great department of the industry, namely, the production of table poultry. We constantly see the farmer exhorted to produce better birds for this purpose, and to a certain extent, and as long as the better article does not cost more than the present bird to produce, the advice is sound. But the production of market poultry is not a question for the general farmer—at least, it has not been found so in other countries, where it is almost entirely in the hands of cottagers and fatteners. At present, in Australia, there is little demand for well-fattened birds; when there is, the supply will be forthcoming, but it will be provided by a special class of poultry men, who will have the necessary facilities and knowledge. The ordinary farm-reared cockerel, of whatever breed, will never meet the demand when it arises, nor would it probably pay the farmer to cater for the trade.

"The above may be taken as a fair statement of the position in market poultry, and it must be confessed that the outlook is not over-promising for a big development in this direction just now.

"Our friends the experts fly, as usual, to the English market as the infallible remedy. They forget, or, perhaps, never knew, that for nine months in the year dressed poultry of first-class, good, medium, fair, and bad quality is cheaper in London than in Australia, and that for the remaining three it is only in first quality, young, well-fattened birds that any shortage exists, and that prices are such as give any possible hope of a profitable outlet there; but this, again, is a question for the middleman. Times are different now to when the South African boom in poultry demand was on, when anything that wore feathers called itself a spring chicken, though even then poultry exporting was not all joy, as two enthusiasts found who realised exactly 6s. 9d. on a £30 consignment of good-quality turkeys, ducks, and chickens.

"Both Victoria and New South Wales have exported largely, though the output is not now so considerable as in former years. In this connection we may quote Mr. G. Bradshaw, the value of whose opinion in connection with the export poultry trade and its development is undoubted. This concisely expressed is, that while export will always be valuable in relieving a glut on this side, thus keeping up prices, the prospects of opening up a very remunerative trade under present conditions are not very encouraging."

The *Adelaide Observer* is also complaining of the wretched poultry offered in that city. In its issue of 23rd June, appears the following:—

"The birds that we see hanging in markets now are only caricatures, and it is little wonder that anything like a satisfactory business in poultry has yet to be established. Far from sending shipments to England, we have even failed to satisfy local consumption. There is an excellent demand in Adelaide for reliable table birds; but, to quote Mr. Laurie, who ought to know, 'the trade remains absolutely untouched.' No one bothers about table birds. The poultry shows give good prizes for table stuff, and excellent dead birds are put up, but the thing stops there. There is no general interest in the subject of growing market fowls, and we see every week the same old scarecrows, that have borne the heat and burden of many a long day, come into the market. A long continuance of this kind of bird has made market poultry an object of derision, and there is the further drawback, that the Australian is very addicted to the large consumption of butchers' meat It may be climatic, and it may be because he cannot get good fowls to eat. Yet the fact remains that the wretched market birds are sold, and the presumption is that they are eaten by some one. Bad as they are, they are only sold for eating. They are generally too old to be good for anything else."

The same paper sent a representative around the auctioneers' rooms during a day in June last, and received the following statements and opinions:—

"Messrs. A. W. Sandford & Co. said: 'Our catalogue of live poultry to-day consisted of about 1,600 birds. There were really no prime fowls offering, nor have there been any for months. To-day's value for fair-conditioned roosters ranged from 3s. 6d. to 4s. 6d. per pair. Good prices will always be given for prime birds, something worth eating. Prime roosters bring 4s. to 5s. per pair.' The Secretary to Adelaide Produce Company reported: 'Prime birds are always scarce in the Adelaide markets. Poultry worth putting on the table are worth 5s. per

couple. It is amusing to hear people talk of sending birds to London market; the figures are not equal to those which can be secured locally for similar birds. We would want ten times the supply to meet local demands.' Mr. H. G. Willcox, another auctioneer, said: 'Good roosters are worth 3s. 8d. to 5s. 6d. a pair, and hens of quality up to 3s. The quality of table fowls at the marts is far from what it should be. It is absurd to talk of export when equally good prices are obtainable at local auctions. We have disposed of some weighty roosters as high as 6s. 2d. per pair, weedy birds going as low as 1s. 10d. per pair.'"

I think the case has now been clearly shown. In Sydney, Melbourne, Brisbane, and Adelaide, there are thousands of weedy birds offered on each sale day, and sell at a mere trifle, while meaty, good quality sorts never reach the local demand. The time may come when this demand will be overtaken, and when it arrives special inducements will not be necessary to direct the surplus to the market awaiting it in London. In the meantime, the late competition has brought out an affirmation from one breeder, that he can rear chickens to 3½ or 4 months old at the cost of 1s. each: while another breeder, who received but 2s. 3d. and 3s. 3d. per pair, says it is more than he was getting in Sydney at the same time, and others are well satisfied with their experience, all tending to, if not the belief, at least the hope, that the dawn of another export trade is upon us.

CHEMICAL NOTES.

F. B. GUTHRIE AND A. A. RAMSAY.

Residue from Acetylene Generators.

INQUIRIES are frequently made as to the commercial value of the lime compounds left behind in the generators in which acetylene gas is prepared, by acting upon calcium carbide with water. An analysis of a sample of such residue is therefore appended.

Moisture	= 41·36	per cent.
Combined water, carbonic acid, and organic matter	= 16·37	,,
Insoluble matter...	= 1·08	,,
Oxides of iron and alumina	= 5·41	,,
Lime	= 36·19	,,
Magnesia	= 0·24	,,
	100 65	,,

There are small quantities of sulphur-compounds (sulphides) present. With the exception of these, which are present in quantities too small to be harmful, there are no deleterious substances present.

The value of this product is due entirely to the lime it contains, other plant-foods, such as nitrogen, potash, and phosphates, being absent. The lime is present either as slaked lime (in fresh samples) or carbonate of lime (mild lime), in samples which have been exposed to the air. It should provide an effective and cheap dressing for all purposes for which liming is recommended, and should be of special value on soils which are sour and deficient in lime or inclined to be stiff, and as a top-dressing for pastures.

Meat-powders, etc., for Poultry Food.

As poultry-farmers are in the habit of giving their fowls ground bones or dried blood or meat-powders, or similar material, as an addition to their ordinary diet, a number of preparations of this nature are in the market under the names of poultry foods or egg-producing foods, &c., for which fancy prices are sometimes charged, and which are in most cases nothing but mixtures of ground bones and meat or blood.

The object of this note is to point out that whilst these substances are admirably adapted for the purpose for which they are given, the price paid should not be more than is asked for the same material as a fertiliser. One of these products has come under our notice which was purchased by a poultry-farmer for 28s. per cwt. The analysis and report of this substance is attached for the information of other poultry-farmers.

Analysis of Poultry-food.

Moisture	=	9·99
Ash	=	21·62
Fibre	=	0·11
Albumenoids	=	56·00 (8·96 nitrogen.)
Fat or oil	=	8·03
Carbohydrates	=	4·25
		100·00

This appears to be a mixture of ground bones, meat, and blood, and is of a very similar composition to samples of nitrogenous bone-dust in the Sydney market (see List of Fertilisers in the May number of the *Agricultural Gazette*, page 448), the values of which as manures are about £7 10s.

The value of the sample, the analysis of which is given above, is £7 11s. per ton, or 7s. 7d. per cwt. (assuming the ash to be for the most part phosphate of lime). As a matter of fact, such a product should be less costly if sold as a poultry food than as a manure, because it is unnecessary to reduce it to such fine powder as is found essential when it is to be used as a fertiliser, a rather coarse product being, indeed, preferable in the case of a poultry food.

I should be glad to hear from any farmer who has been in the habit of paying high figures for poultry food—that is, anything above £8 per ton. Dried blood is worth from £8 10s. to £8 15s., but contains no appreciable quantity of phosphates, its fertilising and food value being due to the nitrogen, which, in local products, is about 12¾ per cent.

Candle-nut Oil.

The candle-nut is the fruit of *Aleurites triloba*, a tree which grows principally in Java, Sumatra, the Moluccas Island, and in the South Pacific Islands. The nuts are interesting on account of the large proportion of oil which they contain, and the product is coming into

demand. The nut has received its name from the fact that the kernel burns like a candle when a light is applied to it; and the natives of some of the South Pacific Islands utilise them threaded on reeds for this purpose. Several such candles, wrapped together in a pandanus leaf, form a torch.

The following gives the composition of the kernels obtained from one of the Pacific Islands.

Analysis of Candle-nut (kernel).

Moisture ...	8·23
Albumenoids	8·04
Oil...	59·93
Fibre	2·62
Ash	3·56
Carbohydrates (by difference), including pectous bodies ...	17·62
	100·00

Nutrient value ...	= 116½
Albumenoid ratio ...	= 1 to 19

Of the 60 per cent. of oil contained in the nuts, quite 55 per cent. should be readily extractable commercially. This proportion is extremely high when compared with the amount derivable from other oil-bearing nuts and seeds, and is equal to poppy seed, which also contains about 60 per cent. of oil. Linseed and hempseed contain from 30 to 35 per cent. oil, and castor-oil seeds 40 to 45 per cent.

The oil expressed from the candle-nut is known under several names: Bankul oil, Eboc oil, also artists' oil. It is a drying oil, and is used in the arts for the same purposes as linseed oil, and also for burning. Its drying power is quite as high as that of linseed oil, and it may be used for all purposes for which the latter is used, namely, in the manufacture of oil-colours, lacquers, and varnishes, and for soap-making. It is used medicinally as a plaster, and as an article of diet—as olive oil is used. The nuts are themselves edible, and, as will be seen from the analysis, have a high nutritive value. The cake from which the oil has been expressed can be used as a cattle food and as a manure, in the same way that linseed and other cakes are used. There is a fair demand for it in England and the Continent for the purposes above mentioned, and there would probably be a good local demand if the supply could be depended upon.

The market value may be estimated at about £18 to £20 per ton.

Orchard Notes.

W. J. ALLEN.

AUGUST.

THE citrus growers of nearly every district are complaining of very light crops, and much of the fruit is only just colouring, being much later in ripening than during ordinary years. In the ordinary course of events, growers would at the present time have been busy picking, packing, and marketing large quantities of these fruits. This year, however, they have

Fig. 1.

had to find other work to occupy their time, and I trust that most of them employed as much of their spare time as was possible in carting either soil or manure in order to assist as far as possible in bringing the trees back into good normal condition. I cannot help but think that there is many an unprofitable orchard in our fruit-growing districts which, had their owners been a little more liberal with manure, would still be yielding fairly good returns.

The latter part of this month is a good time to start the grafting of deciduous nursery stock, and should there be any unprofitable apple, pear, or other trees standing in the orchard, these also may be grafted to good varieties. Grape vines are easily grafted just as the buds are well swollen

and about to burst. Old peach, plum, and apricot trees will be found much harder to graft than either apple or pear trees. If, however, there are any such in the orchard which are unprofitable, it would be as well to cut them back and graft to better varieties; and in the event of the grafts not taking, young shoots might be allowed to grow and buds inserted either in the summer or fall.

Besides the above work, there is the winter spraying with the salt, sulphur, and lime solution, which will kill two birds with one stone, being both an insecticide and fungicide. It answers fairly well in keeping in check the curl leaf of the peach-tree; but for this latter disease, Bordeaux mixture is

Fig. 2.

even better. Trees treated with either of these solutions will show very little curl. The lime, sulphur, and salt is one of the best sprays we have for San José scale; but where trees are badly infested, it is best to give two sprayings, one in the fall and another in the spring just as the leaf-buds begin to swell, and before the trees are in bloom.

For peach aphis the resin and soda is a good useful spray, as is also the blue oil emulsion, but it usually takes several applications to keep this pest in check. Another mode of treatment is to dissolve a cake of Sunlight soap in 2 gallons of water and spray when warm. This is easy to mix, and has given satisfactory results in destroying this pest, and the wash will not

injure the blossom; consequently the trees can be sprayed at any time. It is not safe to use other sprays when the trees are in bloom.

At time of pruning, particularly in young apple orchards, a sharp look-out should be kept for the appearance of woolly aphis, and should any trees be found infested they should be carefully pruned, removing and burning as many of the infested twigs as possible. Then either scrub the trees thoroughly with a strong kerosene emulsion or fumigate with hydrocyanic acid gas so as to eradicate this pest if possible.

All old bark should be scraped from apple, pear, and quince trees, and the scrapings burnt, and everything in the orchard which would be a harbour for codlin moth destroyed.

Keep all fruit-houses as clean at possible, as there is no doubt that they are responsible for harbouring a great many moths every year, therefore keep the rooms as air-tight as possible; and as soon as the moths begin to hatch in the spring, burn sulphur fumes in the rooms once every other day for a fortnight so that the moths may be destroyed as they begin to fly.

In working around vines, keep a sharp look-out for the pupæ of the vine moth. If there are any old, partially rotted stakes, the moths will be found adhering to these, and also to the old bark which is hanging to the vine. Crush these wherever found, and thus assist in keeping down this pest as far as possible.

Growers who intend using quick-acting fertilisers should make the first application this month. It is best not to apply too much at one time, but rather make two applications—one now, and one after the fruit is well set.

Fig. 1. –Three-furrow plough which we use in our orchards. Two strong or three medium-sized horses can plough several acres a day with this implement. By the use of this and other labour-saving implements, pictures of which will be shown in these Notes from time to time, the cost of working an orchard can be reduced to a minimum.

Fig. 2 is a young tree in our Glen Innes apple orchard taken eighteen months after planting. It will be seen that it is a low-headed tree, with limbs starting out within a few inches of the ground. This is a well-shaped tree, and I would recommend orchardists to try and start their trees with lower heads than has been the general practice heretofore.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

Directions for the Month of August.

Vegetables.

This should be a busy time both in the vegetable and flower garden, for during the month of August, spring in many districts sets in unless the season happens to be a late one. Up to the time of writing, the weather has been wonderfully mild, therefore it is quite possible that we may have a late winter. It would be rash, then, to sow to any great extent seeds of the tender kinds of vegetables. These would, perhaps, be safe enough in the districts bordering the coast to the north of Sydney. About the mountains and the eastern and western slopes, frosts may be very severe during the month, and the next month also.

The tender kinds of vegetables, such as tomatoes, egg-plants, sweet potatoes, and capsicums, can be raised in a warm corner of the garden, but the plants will need protection, especially during the night-time, and seedlings raised in the early part of the month can, with safety, be planted out in the garden, towards the end of the month, in all rather warm districts.

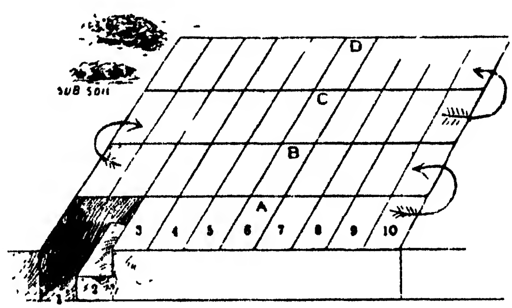
Every farm should be provided with fruit, vegetable, and flower gardens. Those who shirk the work make the excuse that they have no time for that sort of thing; that the general farming work occupies every moment of time. This is a poor excuse. It is a man's duty to provide for the health and comfort of his family, and if he pleases he can grow all the comforts needed, that is, if he has an inclination to do so, and should he have no knowledge of gardening he can soon gain all he requires by simply the asking.

It is a very good time this month to start a garden, if it be only for the growing of a few pumpkins or a few potatoes, and the time occupied in making the garden need be but trifling, even to do it well; but instances may be seen by the hundred where the farmers will not take the trouble to put in even a single pumpkin seed.

Asparagus is a good vegetable to grow, and one that gives but little or no trouble after it becomes established. Plants 1, 2, or 3 years old may be planted at any time during the month, and even during the following month, provided they have not started into growth. As soon as possible get the ground ready. It should be ready some little time before planting, but there is good time yet. Trench 2 feet deep, keeping the top soil on the top and the bottom soil at the bottom, for it is but rarely that the bottom soil, when brought to the surface, is in a suitable condition for plants. To do this easily divide the land to be trenched—indeed the whole of the garden would be the better for trenching—into two parts, or, if a large patch, into

four, as in diagram. Start work at one end of A and let it be divided into strips, say, 3 feet wide. Take out all the surface soil to about 1 foot in depth, and put it in a heap at the end, as shown. Then take out the surface soil of the next strip 3 feet wide, and heap this with the soil already taken out. Then take out the bottom, or subsoil, and keep this by itself near the heaps of surface soil, but do not mix it with them. Then dig out the subsoil which was under the second strip, and put it into the bottom of the trench made when the bottom soil of the first strip was taken out. Then put the top soil of the third strip on top of this. Continue in this way the whole of A, and, when you come to the end, turn round and manage B in the same way, and so on to the end; then you will find an empty trench and half a trench to fill in, but the subsoil and the surface soil will be there all ready—all you have to do will be to shovel it in.

By trenching in this way, not only will the surface soil be kept on the top and the subsoil beneath, but both top and bottom soil will be thoroughly broken up and aerated. As the operation of trenching is proceeding, as much



manure as you please may be mixed with the soil; and for such vegetables as asparagus or rhubarb it would be just as well to apply a good deal of manure, unless the soil is in good heart.

When planting asparagus open up a trench (not very deep), and round up the bottom of it. Set the plants on top of the rounded part so that the roots can be spread out evenly and nicely, and then fill up with soil. The depth of the top of the rounded part below the surface of the soil should be so deep only that the tops of the plants will be not more than an inch or two below the soil. If the roots be bundled together and stuck into a hole, the plants are not likely to grow very well.

Artichoke, Globe.—This is not much of a vegetable, and hardly worth the space it would occupy, but if anyone desires to try it, let him plant towards the end of the month. Each plant will occupy a considerable space, so that if more than one plant is grown, the distance they should stand apart should be at least 4 feet.

Artichoke, Jerusalem.—This is really not an artichoke but a kind of sunflower, and it is one of the best and easiest of vegetables to grow, and if too much of this good thing should be raised, the pigs will take the surplus with

gratitude, and thrive well on it. Plant during the month, the earlier the better, in trenches 3 or 4 feet apart. Drop the tubers in trenches made about 5 or 6 inches deep about 1 foot from each other. Cover up and keep down weeds by cultivating well from time to time between the rows.

Beans, French or Kidney.—This tender bean has been plentiful in the market up to the present time of winter, which shows that there are many places where frosts have not yet appeared. In all the warm districts a few seeds may be sown for a trial during the beginning of the month, and more towards the end. But if cold frosty weather sets in, delay the sowing and wait for warmer days.

Beet, Red.—This vegetable should be grown wherever possible, so that a supply may be available as long as possible. Sow a few short rows from time to time, keep the plants free from weeds, and thin them out well. When the ground is being prepared for sowing, avoid applying fresh or rank manure. The best plan is to follow cabbage, cauliflower, or other vegetables for which a good deal of manure had been used. The best kinds to grow are the short, stumpy and turnip-rooted or globe varieties, as they are named.

Beet, Silver, sometimes known as Spinach.—One of the most useful vegetables to grow, and the return from a few well-grown and well-cared-for plants should be quite heavy. When preparing land for the plants use abundance of good manure—that is, farm-yard manure. The seed may be sown in seed-beds, and the young beets afterwards transplanted to a bed prepared for them. Half a dozen plants will probably be found sufficient at a time. When the leaves are well-grown, pull off the outside ones only for use.

Cabbage, Cauliflower, Brussels Sprouts, Brocoli, Savoy, Kale.—Sow seed of any of these vegetables from time to time to keep up a succession of plants. Very little seed need be sown, for it is no use having an over supply of plants for which no use can be made. Prick out seedlings of above as soon as they are large enough to handle, and plant out any well-grown plants which had already been pricked out. Shift these with a good deal of care in order to break as few roots as possible. Should the ground be quite dry when you desire to plant, water the plants to be moved thoroughly, give them quite a good soaking overnight, and if they are watered after planting they will not feel the shift. All the vegetables named require rich soil, and if it be not naturally rich, apply abundance of well-rotted (not fresh and rank) farm-yard manure. As warm weather may set in it would not be amiss to spread a good mulch about the plants.

Celery.—A little seed may be sown in seed-beds, or better still, in a box. As soon as the plants can be handled, prick them out, and later on transfer to shallow trenches which have been heavily manured. During the time of growth, and until they are about to be blanched, the plants will need a great deal of water if the season is dry, as well as some liquid manure occasionally.

Celeriac, or turnip-rooted celery.—Manage as for the above, except that the plants need not be planted in trenches. This is a useful vegetable for soups, stews, &c.; its turnip-like roots are used instead of the leaf-stalks like the ordinary celery.

Carrots.—Seed may be sown from time to time to keep a continuous supply going. This is a most useful vegetable, and one which the gardener should never be without. Sow the seed in drills about 1 foot to 18 inches apart. Try several kinds, and probably the short rooted varieties will be found the best for general use. If the seed be soaked for a few hours before it is planted, and the drills watered, should the ground be dry, the seed will germinate much sooner than if it be sown in a dry condition. As a rule, it takes quite a long time to come up, and care must be taken to keep down weeds or the young carrots would become overgrown.

Cucumber.—Only in warm localities should sowing seed be chanced in the garden. Plants can be raised under cover, however, and when frosts are over the young cucumbers can be planted out.

Leek.—This vegetable is not much used, but it is a good wholesome one and well worth the growing. Sow a little seed occasionally in seed-bed, and as soon as the seedlings are 6 or 8 inches in height they can be transferred to the garden. The soil should be made very rich in order to grow good leeks.

Lettuce.—Seed may be sown from time to time in order to keep sufficient plants on hand for planting out. Before moving them water well, and disturb the roots as little as possible when taking them out of the ground. Water again after planting if the soil is dry.

Onion.—Plants already raised in box or seed-bed should be planted out by degrees, taking the largest plants first. This method of growing onions is a good one for gardens, and success in growing them is more likely to be attained than by sowing the seeds where the onions are to grow. As onions are largely used for domestic purposes, it is desirable that sufficient be grown for requirements. Use a good deal of manure for them, working it well with the soil at time of preparing the ground for the plants, or seeds if sowing in the garden is necessary. Keep the onion plants free from weeds, and work the ground between the rows frequently. Before gathering the bulbs for keeping purposes they should be thoroughly ripe, and this may be seen by their stems dying down. Do not leave them in the sun after they are dug up any longer than can be avoided. The rows should be about from 12 to inches apart, and the distance from bulb to bulb must depend upon the size which the particular variety is likely to attain when mature. If seed be sown in the garden, be careful not to cover it deep. At the outside it should not be covered with fine soil more than a quarter of an inch.

Parsnip.—Seed of this deep-rooting vegetable may be sown during the month as extensively as may be needed. The ground should be dug deep. Old manured ground will be the best, for if fresh manure be used the parsnips will probably become forked or misshapen.

Peas.—Sow as much as may be needed to keep up a continuous supply, if possible. The rows may be 3, 4, or more feet apart, according to the height the peas are likely to attain. Sow the seed about 4 inches apart and 3 inches deep.

Radish.—Sow a little seed occasionally in well-manured ground, using well-rotted manure. Use the radishes whilst they are quite young and tender. When they become hollow or pithy they should be given to the pigs.

Rhubarb.—The directions given for preparing ground for asparagus are applicable to the rhubarb. Plant just as the leaf buds are starting into growth, and keep the crown of the plant an inch or so below the surface. The trench with rounded bottom for asparagus is unnecessary for rhubarb.

Salsify.—Seeds may be sown now if a trial is desired. Sow in rows about 15 inches apart. The best kind of soil for this plant is sandy loam. The rows should be about 15 inches apart, and when the seedlings come up they should be thinned out to about 6 inches apart.

Swede.—Sow in rows a little seed from time to time to keep up a supply.

Potato.—Plant a few rows during the month of any early variety obtainable. Manure the ground well, dig the ground well, and drain well. Sow whole potatoes of a medium size, unless the seed is scarce, when they may be cut into sets.

Turnip.—Sow a little seed occasionally in rows about 15 inches apart

Tomato.—In warm districts, plants already raised under shelter may be planted out, but some protection may be necessary at night, for frosts may come, even in warm districts, and destroy the plants if unprotected. Seed may be sown to any extent needed, but under protection.

Flowers.

The flower garden deserves far more attention than it is possible to give it in these brief notes, for a flower garden is a most desirable adjunct to a farmer's home. The surroundings of the house should be made as pleasant and attractive as possible, and this is by no means difficult, considering the facilities which should be at hand for so doing. Even a few vines grown around the house, making a sort of extensive verandah, would be an immense improvement to many houses which are bare, ugly, and unattractive in the extreme. Grape vines answer admirably for this purpose wherever they will grow. Climbing roses of different kinds, Wistaria, Honeysuckle, Jasmin, Clematis, and numerous other climbers and creepers can be made use of about the house.

At the end of the month, numbers of tender annuals may be sown in pots or boxes for planting out when the seedlings are ready. Old favourites such as balsams, cornflowers ,coreopsis, candytuft, sweet peas, lupins, salpiglossis, scabious, mignonette, nasturtium, stocks of the ten-week kinds, Phlox Drummondii, and no end of pretty things may be sown now.

Evergreens, such as pines, camellias, laurestina, laurel, box, bay tree, pittosporums of variety, veronicas, palms, or any other evergreen, may be planted ; but the safest time to plant is in the early autumn. However, if care be taken, and the plants watered and well looked after, they may get along all right.

Roses may be pruned towards the end of the month, cutting away all dead wood in the first place ; then all rough, misshapen stuff, and all weak, thin little branches. The strong-growing kinds should not be pruned severely, or else they may produce nothing but strong shoots ; but weak-growing kinds may be pruned hard to induce the growth of new wood. Roses may be planted if the roots have not started to grow.

Farm Notes.

HAWKESBURY DISTRICT—AUGUST.

H. W. POTTS.

THE month of July will long be remembered for its mildness and absence of rain. As forecasted a few months ago, we are passing through a period of drought only exampled by that of the winter of 1902. The crops are suffering keenly, and threaten to prove a failure in several places along the valley. Necessarily the light sandy soils are suffering most.

Despite its very unfavourable conditions, it is essential that every effort should be made to get the soil into good friable order. The richer soils will need deep cultivation, and got ready for sowing maize. The use of the subsoiling plough will be in greater need this winter, owing to the extreme dryness of the under soils. It is a matter of urgency that every effort should be made to loosen these soils, to act as reservoirs for moisture should we be fortunate enough to have a wet spring. A porous subsoil is the key of the situation under such circumstances. It has to be remembered that the maize plant roots penetrate to a great depth, and that it needs ample moisture to produce well-developed stalks and cob.

Farm-yard manure is the most valuable of all fertilisers this season, to increase the moisture-holding capacity of the soil, to create humus, and to improve the mechanical condition of the soil or its texture. Great quantities are not advisable for maize under average conditions; but this season the amount should be increased, to improve the state of the soil. Ten or twelve loads to the acre may be used for those varieties noted for quick growth and leafy foliage, and intended for early summer forage crops. Where this class of fertiliser is not available, that recommended by Mr. Guthrie is most suitable :—

Dried blood	320 lb.
Bone-dust	250 ,,
Superphosphate	400 ,,
Sulphate of potash	150 ,,

Mixed and applied at the rate of 2 cwt. per acre.

Early sown crops are indicated this year to provide green food, owing to the shortage of spring forage. Riley's Favourite, Iowa Silvermine, Pride of the North, and Hickory King are suitable varieties.

Sorghums and Millets.—Towards the end of the month it will be advisable to make early sowings of these valuable crops for early summer feed, and, in such case the crops should be drilled in 3 feet apart, to be able to carry out shallow cultivation. Early Amber-cane and Planter's Friend do best in our light sandy soils. From 7 lb. to 10 lb. of seed to the acre will be ample. It will be well this season to recall the experience we had during 1902, when

similar shortage of moisture prevailed, when a splendid growth of millets provided excellent forage at a time when it was much required. The variety known as White French was used, and it justified the reputation it bore for giving good returns on light dry soils. The land should be thoroughly well cultivated and brought to a fine state of tilth. A manure of ½ cwt. each bone-dust and superphosphate to the acre will be beneficial. The seed may be sown broadcast, from 7 lb. to 10 lb. to the acre. With favourable weather, the crop will be available for green feed in from sixty to seventy days.

Potatoes.—The best mechanical state of the soil is needed for this crop, and attention should be devoted to getting the land ready. Deep ploughing, thorough cultivation, and rich manuring will repay the expense and labour. Where farm-yard manure is available, it will be the best to fertilise with, provided it is well decomposed. A substitute may be provided in commercial fertilisers, such as that recommended by Mr. Guthrie:—

Dried blood	400 lb.
Superphosphate	500 „
Sulphate of potash	220 „

Mixed and spread about 6 cwt. to the acre. On our light soils, Aroostook County Prize, Up-to-date, Beauty of Hebron, and Early Northern have given good yields. The best sorts on heavier soils are Brownell's Beauty, Early Rose, Bliss's Triumph, Medium Ruby, Breese's Prolific, Manhattan, and Cambridge Kidney.

Mangolds and Sugar Beets.—With deeply cultivated and richly manured soil, the Mammoth Red and Yellow Globes may be sown this month.

Glen Innes District—August.

R. H. GENNYS.

Barley may be sown for green feed, and Skinless barley may also be sown for hay purposes.

Rye may be sown for green fodder. Emerald Rye has been found best here so far for this purpose. Ryes if cut very early—just when they are coming into head—make very fair hay if properly cured.

Peas may be sown with advantage this month.

Onions may be sown, and any young plants transplanted.

Get land ready for all spring crops such as maize, sorghums, millets, cow-peas, pumpkins, melons, cucumbers, &c., and other spring vegetables.

Wheat may still be sown here for hay. Sow thickly. Very late for grain, but in this late district a fair crop is still possible. When wheats are well rooted, but show signs of going back through dry weather, harrow them with a light harrow, and if the lever harrows are used turn the tines

backwards towards the driver. If the grain has been drilled in, harrow across the drills rather than in the direction they are planted, as less plants will be torn up in the operation.

Oats may be sown on the New England table-land with advantage this month or even later; but, as with other cereals, sow thicker as the season advances. Oats respond to good cultivation—that is, deep and thorough ploughing; but the surface before sowing, if broadcast, may be left a good deal rougher than for barley or wheat, as the light nature of the seed makes it more difficult to cover. Oats do well on heavy, moist land—but not where stagnant water lies—much better than wheat; but will also flourish well on lighter soils. They do not, however, stand hot dry weather as well as wheat, and in our driest districts are better left alone. They do not stand harrowing as well as wheat when growing, as their roots are shallower, and they are more liable to be torn up. Oats make good green feed for milking cows, but are not so sweet as wheat. Most varieties are quick growers, and are much used in some dairying districts. When sowing for hay, more especially if late, sow plenty of seed. As much as 3½ bushels to acre are not too much, and for grain from 2 to 2½ bushels per acre. With Algerian, if sown early much less may be used, as the variety is a great stooler. For hay, oats should be harvested when the tops are just beginning to turn. If cut with a binder, do not stook too closely, and give the sheaves plenty of time in the field, as oats is a crop very liable to heat if stacked too green. If the sheaves do not dry readily enough, especially after wet, when the outside is quite dry, turn them inside out. Avoid this, however, if possible, as it does not tend to improve the colour, for colour in hay or chaff is a very important market factor. When cutting for grain cut rather on the green side, as much is lost in some varieties by shedding.

Algerian oats are coming to the fore rapidly. The year before this a small garden plot here yielded at the rate of 94 bushels to the acre, and on the strength of this experiment an area of 15¼ acres was planted, threshing the good average of 70 bushels per acre of prime oats. Algerians also make very good hay, the straw being fine; but it does not grow quite tall enough in this connection. Red Rust-proof is a fine hay oat; grows somewhat similar to Algerians, but taller, and the earliest we have here has so far resisted rust well. Danish Island is a good all round sort, and in the field lots yielded 57 bushels per acre. It appears to resist rust fairly well, and is one that can be generally recommended.

Tartar King is a good oat for grain, but has a crooked neck, and is therefore not very good for the stripper.

Golden Giant is another good all round kind that did well this year, the yield of the field crop being over 40 bushels to the acre.

White Tartarian a good hay yielder, but not too sweet; yielded for grain over 40 bushels to the acre.

Surprise has a nice plump grain good for feed, but the neck of the straw is very weak and apt to bend over or break off with a heavy crop. The yield this year was the lowest, being 23 bushels to the acre. The above were all

grown in fairly large areas. Those grown in the small experimental plots yielded much higher, the lowest being Carter's Royal Cluster at the rate of 46 bushels per acre, and the highest Wide-awake Oats at the rate of 92 bushels an acre. To sum up, the northern tablelands appear to be specially adapted for growing oats, more especially on the rich, heavy soils.

Bathurst District.—August.

R. W. PEACOCK.

All the wheat should be well above ground. Any that is winter-proud should be eaten off by stock before the middle of the month, after which it should be allowed run up for the main crop.

Oats may still be sown especially upon the rich alluvial soils. Upon the lighter soils they should be well over the ground.

Barleys and ryes may be sown for green fodder.

Peas and tares may be sown, but heavier crops should be expected if sown earlier.

Lucerne paddocks should be worked with spiked roller or narrow-tined cultivator to stir the surface and destroy some of the weeds. They should then be allowed to produce a crop. Grass paddocks of Prairie, &c, should be cultivated, which very often renews the vigour of the plants.

Land should be prepared for the various spring crops, such as potatoes, pumpkins, melons, artichokes, mangolds, carrots, sorghums, millets, maize, etc.

Farm-yard manure of all descriptions should be carted to adjacent fields.

Fences and out-buildings should receive attention.

In the vegetable garden sow peas. Make small sowings of carrots, parsnips, beet, lettuce, broad beans, and radish. Sow in seed-beds cabbage and Brussels sprouts. Sow in seed-boxes or frames, tomatoes, chillies, Cape gooseberries, and egg plants. Transplant cabbage, cauliflower, lettuce, rhubarb, asparagus, and eschalots.

Crown Lands of New South Wales.

The following areas will be available for selection on and after the dates mentioned :—

FOR ORIGINAL HOMESTEAD SELECTION ONLY.

H.S. No.	Name of Land District	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date Available.
		acres.					
998	Grenfell	1,600	20	66 acres to 103 acres.	Public School, village of Gooloogong, from about 1 to 3½ miles; Cowra Town and Railway Station from about 24 to 26 miles.	£1 4s. 10d. to £1 18s. 8d.	20 Sept., 1906.

Mostly level country; reddish, sandy, and in places loamy soil; box timber, mostly dead and ringbarked; some box suckers; rainfall, 22 inches. No natural water supply; could be conserved by tanks, and probably obtained by sinking. Lachlan River (permanent) from ¼ mile to 2½ miles distant. One block has frontage to Goonigaldoorigang Creek, which is not permanent.

FOR ORIGINAL CONDITIONAL PURCHASE AND CONDITIONAL LEASE IN VIRTUE THEREOF—(Classified under Subsection 1 B Section 4, of Crown Lands Amendment Act, 1905).

Name of Land District.	Name of Holding, &c.	Parish.	County	Total Area.	Price per Acre.	Date available.
				a. r. p.	£ s. d.	1906.
Bellingen ...	Within Resumed Area 973.	Newry .. .	Raleigh	380 0 0	1 0 0	20 Sept.
On south arm of Bellinger River (salt water); partly suitable for cultivation.						
Carcoar	....	Bracebridge .	Bathurst .	580 0 0	0 16 8	20 Sept.
On Milburn Creek: fairly good grazing land; heavily timbered.						
Condobolin .	.... ..	Gindoono and Mt. Nobby.	Cunningham	2,560 0 0	0 10 0	16 Aug.
Suitable for grazing.						
Forbes .	Bandon & Nanima Holdings (partly).	Bandon and Cumbijowa.	Forbes .	680 0 0 and 1,266 0 0	1 0 0	30 Aug.
Good grazing land, part suitable for cultivation.						
Forbes	.....	Boyd	Forbes ..	245 0 0	1 0 0	13 Sept.
Fair grazing land, the greater part suitable for agriculture.						
Glen Innes ..	.. ..	Clifton	Gough ..	340 0 0	1 15 0	20 Sept.
Good grazing, suitable in part for cultivation.						
Lismore.. ..	....	Nimbin	Rous.. ..	240 0 0	1 0 0	30 Aug.
Steep and broken country; heavily timbered; suitable for grazing.						
Moruya.. ..	....	West Nelligen ..	St. Vincent..	354 0 0 305 0 0 207 0 0	0 7 6 0 12 6 0 15 0	9 Aug. 9 Aug. 9 Aug.
Suitable for dairying after improvement, and for homes for timber-getters and fishermen.						
Mudgee	....	Rouse	Wellington ..	840 0 0	1 0 0	30 Aug.
Stony ridges with permanent water; suitable for grazing, and for homes for persons employed in the district.						
Murwillumbah..	Within Resumed Area 1,007.	Goonimbar	Rous	162 2 0	2 0 0	9 Aug.
On Graveyard Creek and south arm of Tweed River: suitable for dairying.						
Parkes .. .	....	Gunningbland ..	Ashburnham	475 0 0	1 3 4	13 Sept.
Suitable for grazing and agriculture.						

FOR ORIGINAL CONDITIONAL PURCHASE ONLY—(Classified under Subsection 1A, Section 4, of Crown Lands Amendment Act, 1905).

Name of Land District.	Name of Holding, &c.	Parish.	County.	Total Area.	Price per Acre.	Date available.
				a. r. p.	£ s. d.	1906.
Bingara* ..	Within Bingara suburban lands.	Molroy	Murchison ..	206 2 10	3 0 0	20 Sept.

Sloping country, lightly timbered with ironbark, box, and pine; red and gravelly soils; good grazing land, partly suitable for cultivation; prickly-pear fairly thick over the greater part of the area; no natural water supply.

Cootamundra .	....	Cowcumbala ..	Harden ..	50 0 0	3 10 0	6 Sept.

Suitable for grazing, dairying, or agriculture.

Murwillumbah..	....	Billinudgel	Rous	66 0 0	6 0 0	16 Aug.

Suitable for dairying and cultivation.

* Identical with special area, see below.

CONDITIONAL PURCHASE (ORIGINAL OR ADDITIONAL) OR CONDITIONAL LEASE (available by revocation of reserve, and not classified or specially set apart under section 4 of the Crown Lands Amendment Act of 1905).

Bombala and Eden.	....	....	Wallace, Wellesley & Auckland.	39,600 0 0	1 0 0	13 Sept.

Being strips of land, 1 mile wide, along parts of the boundary between New South Wales and Victoria.

Kempsey ..	....	Yarrabandini ..	Dudley ..	360 0 0	1 0 0	6 Sept.

Suitable for grazing.

ORIGINAL CONDITIONAL PURCHASE AS SPECIAL AREA.

Bingara Land District, within Bingara suburban lands, 206 acres 2 roods 10 perches, maximum area 12 acres, minimum area 3 acres 2 roods, parish Molroy, county Murchison; price, £3 per acre; sloping country, lightly timbered with ironbark, box, and pine; red and gravelly soils; good grazing land, partly suitable for cultivation; prickly-pear fairly thick over the greater part of the area: no natural water supply Available for original applications only, on 20th September, 1906.

FOR IMPROVEMENT LEASE.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Upset Annual Rental per Block.	Date of Sale or Tender.
	EASTERN DIVISION.						
			acres.		acres.	£ s. d.	1906.
634, 635	Cooma	Kalkite	1,040	2	640 and 400	4 0 0 and 3 6 8	Sale. 13 Aug.

The first mentioned block consists of slate and granite formation, chiefly steep and rocky; parts open forest, parts densely timbered with gum, sally, and mountain ash, parts scrubby; soil light and shallow, not suitable for cultivation; water supply abundant and permanent in Eucumbene River; and the second block consists of slate and granite formation, part steep with small fringe of open country along Gungarbin River frontage, part quartz ridges; soil light and shallow, not suitable for cultivation; timber, gum, mountain ash, and wattle; water supply abundant and permanent in Gungarbin River. The blocks are summer grazing country; within snow belt; rabbits exist, native dogs are numerous; ample rainfall; situated about 35 miles westerly from Cooma.

166, 167, 168, and 629	Windsor	....	15,827¼	4	2,940 to 5,840	10 0 6 to 18 5 0	Sale. 13 Aug.

The land is of an inferior character, with small flats along the watercourses; the ranges are rugged and rocky and afford but scanty and rough depasturage; the country is covered with forest of stringybark, gum, ironbark, bloodwood, oak, and apple, interspersed with scrub rather thick in places; blocks 167 and 168 have frontage to Wollemi Creek, block 166 is intersected by Long Weeney Creek, and block 629 is intersected by Putty Creek; water supply generally permanent. Rainfall, about 31 inches per annum. Native dogs, wallabies, &c., are numerous. Situate from 40 to 60 miles south-westerly from town and railway station of Singleton.

For Improvement Lease—*continued.*

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Upset Annual Rental per Block.	Date of Sale or Tender.

Central Division.

			acres.		acres.	£ s. d.	1906.
1415	Coonabarabran . .	. . . .	. . . .	1	221	18 8 4	Sale. 20 Aug.

Undulating country, densely timbered and scrubby; generally hard red gravelly soil; a small area of rich loam suitable for agriculture; eastern portion very stony, western portion yellowish gravelly soil, south-west portion light sandy loam. Good water holes in Merrygoen Creek sufficient for ordinary seasons; in times of drought water can be obtained by sinking in the bed of the creek. Average annual rainfall, about 27 inches. Rabbits are numerous. Situated about 6 to 8 miles east from village of Mendooran, and about 47 to 50 miles easterly from Gilgandra Railway Station.

1418, 1419, and 1420	Dubbo	Minore	1,085¾	3	840, 562, and 283¾	14 0 0, 4 13 8 and 2 7 4 respectively.	Sale. 13 Aug.

The first block consists of gently undulating sandstone basaltic country, depository and alluvial formation, about one-tenth the area is rich alluvial river flat, about one-fourth good box valley and slope country, the remainder sandstone and conglomerate, fair to very poor heath country; timbered with dense pine, wattle, oak, and some heath and other scrubs over about three-fourths of the area, permanent water in the Macquarie River. Average annual rainfall about 22 inches. Rabbits are becoming very numerous; and the other two blocks consist of undulating granite and sandstone country; poor sandy loam merging into sand, timbered with pine, box, wattle, and gum seedlings, scrub oak, tea-tree, heath, &c.; no natural water supply, but there are fair tank catches. Average annual rainfall about 22 inches. Rabbits are rapidly increasing. The blocks are situated from 8 to 12 miles westerly from town of Dubbo.

658*	Nyngan	West Bogan scrubbed lands.	. . . .	1	5,025 (ex road)	26 3 6	Tender. 14 Aug.

Level and undulating country; fair to good red sandy loam, timbered with box, pine, yarran, and some mallee. No natural water supply. Distant 18 miles from Hermidale.

*491 and *654	Nyngan	West Bogan scrubbed lands.	8,373	2	3,303 and 5,070	24 1 9 and 15 18 11	Sale. 14 Aug.

The first block consists of undulating, fair to good red loamy soil, with low gravelly ridges; clay and gravelly subsoils; timbered with box, pine, coolabah, budtha, and yarran. No natural water supply; good catches for tanks. Nyngan, 14½ miles; Miandetta Siding, ½-mile. And the second block consists of level and undulating country; fair to good red sandy soil; poor sandy soil in the mallee; box, pine, and budtha; about 1,220 acres of mallee. No water supply. Hermidale, about 20 miles distant, and Nyngan, about 35 miles.

1430	Nyngan .	Canonbar	...	1	1,210	7 11 3	Sale. 13 Aug.

Level country, timbered with box, pine, and budtha, and pine, budtha, and currant bush scrub; some light box seedlings, red loamy soil, with clay subsoil. No water supply, good facilities for conservation. Average annual rainfall, about 18 inches. Rabbits are fairly numerous. Situated about 23 miles southerly from town and railway station of Nyngan, and about 22 miles southerly from "Miowera" siding.

887, 888, and 889	Parkes and Forbes .	East Billabong .	15,160	3	4,160 to 6,750	8 13 4 to 14 1 3	Sale. At Parkes, 20 Aug.

Greater part broken ranges of sandstone formation, remainder, flats and slopes; timber: ironbark, stringybark, gum, box, pine, black pine, currawong, and sheoak, suitable for grazing; about 550 acres suitable for agriculture, a spring exists on block 889, there is no other permanent natural water, but excellent facilities exist for conservation by means of tanks and dams. Infested with rabbits; kangaroos, wallabies, and native dogs also exist. Average annual rainfall, 23 inches. Situated about 11 miles easterly from town and railway station of Parkes.

1409	Warialda	Biniguy .	.....	1	580	2 8 4	Sale. 20 Aug.

Level country; red and brown soils, slightly sandy in places; thick forest country, timbered with box, brigalow, belah, and pine, and brigalow, pine, and wilga scrubs. No permanent water supply; fair dam sites. Average rainfall, about 24 inches. Rabbits exist. Situated about 4 miles south from Biniguy railway station, and about 5 miles south-westerly from Gravesend station.

351	Warialda ..	Bengalla .	......	1	13,700	5 8 4	Sale. 21 Aug.

Slightly undulating country, with a few stony knobs on western side; about 2,000 acres of fairly open forest country, timbered with oak, pine, ironbark, tumble-down gum, and a little box; about 6,000 acres of thick forest country and scrub combined, timbered with pine, tumble-down gum, oak, and ironbark, with scrub of heather, dogwood, five-corners, wattle, &c.; and 5,000 acres of thick low scrub of heather, wattle, dogwood, five-corners, oak, and pine, with odd trees of tumble-down gum, oak, pine, and ironbark; poor sandy soil of sandstone formation. No natural water supply, but water can probably be obtained by sinking; the catchments for tanks and dams are poor. Rainfall, about 28 inches per annum. Wallabies and dingoes are numerous. Situated about 12 miles north-easterly from Yetman, and about 30 miles south-easterly from Boggabilla.

* The upset annual rental covers the present value of scrubbing done on these blocks, so that no further payment is asked in respect of such expenditure.

AGRICULTURAL SOCIETIES' SHOWS.

1906.

Society.	Secretary.	Date.
National A. and I. Association of Queensland ...	....	... Aug. 7 to 11
Forbes P., A., and H. Association	... N. A. Read	... „ 8, 9
Corowa P., A., and H. Society	... H. L. Archer	... „ 14, 15
Moana A. and P. Association	... C. L. Blair	... „ 15
Parkes P., A., and H. Association	... G. W. Seaborne ...	„ 15, 16
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Agricultural Gazette of New South Wales.

Forestry.

Some Practical Notes on Forestry suitable for New South Wales.

[Continued from page 632.]

J. H. MAIDEN,
Government Botanist and Director of the Botanic Gardens, Sydney.

XV.

Forests considered in their relation to Rainfall and the Conservation of Moisture.

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1. Introductory.

I bring before you the subject which is often conventionally known under the title of "Forests and Rainfall," and in regard to which it may be fairly said that there still exists, in New South Wales at least, a considerable amount of misapprehension. Even the clear-cut statements of Mr. Russell, our late Government Astronomer, that forests do not increase rainfall, have failed to carry conviction to some people, for the reason, I take it, that the broader subject of the effect of vegetation on the *conservation* of moisture has not been fully considered in some of the public discussions that have taken place. The term "Forests and Rainfall" has been adopted by many

writers, because of its compactness, but if its use becomes misleading, then it should be amplified. We want to carefully separate two issues :—

1. The effect of forests and other vegetation in increasing the rainfall.
2. The effects of the same in conserving moisture.

I approach the subject with but elementary meteorological knowledge, but I have had much experience of Australian forestry. Taking an extensive territory, it appears to be indisputably proved that forests do not increase rainfall; it is as fully well proved that they conserve the rain that falls, and therefore every effort should be made to save them from unnecessary destruction.

Most of what follows is based upon a paper read by me before the Royal Society of New South Wales in 1902.

A thoughtful paper by Mr. Walter Gill,* Conservator of Forests of South Australia, is well worthy of perusal. He deals with evidence gathered from official reports and other sources, in different countries, in regard to the effects of forests and their destruction on the rainfall and available moisture generally. The paper is temperately worded, and contains much sound advice, which should be well pondered over by "every individual member of an intelligent democracy."

Let me invite attention to *Bulletin* No. 7 of the Forestry Division of the United States Department of Agriculture, entitled "Forest Influences." It contains masterly papers by Professors M. W. Harrington and B. E. Fernow, to which I am much indebted.

There is so much postulation, theory, and uncertainty of observations in regard to the whole subject, that I am unable to classify the statements as rigidly as if I were dealing with exact science. I have, however, avoided repetition as far as possible.

2. The Historical Method.

(*a*) *General Observations* :—

Popular writers usually rely upon the historical method in support of their well-intentioned arguments on this question, but although this method has been superseded by the scientific method, which relies on observation and experiment, it is proper to deal with historical evidence at this place.

Loffelholz-Colberg published, in 1872, a comprehensive catalogue of publications on forest questions which is, of course, now much out of date. His list begins with Fernando Columbus, the son of Christopher Columbus, who attributed the heavy rainfall of Jamaica to its wealth of forests, and the decrease of rainfall on the Azores and Canaries to the removal of their forests. In the sixteenth and seventeenth centuries the subject was already attracting the attention of the French Government, and in fact Governmental interest in the subject goes back to the time of the immediate successors of Charlemagne. It is interesting to read over the abstracts of opinion which are recorded by Loffelholz-Colberg. Every variety of opinion can be found there, from those which attribute to the forest almost everything which is desirable in climate, and even endow it with a powerful influence on morals, to those who believe it to be entirely without influence; and from those who think that its influence does not extend beyond its own margin, to those who would attribute the deterioration of the climate of the Old World to the removal of the forests of the New.

* "Deforestation in South Australia; its causes and probable results." Adelaide Meeting, *Aust. Assoc. for Adv. of Science.*

Leaving out of account the solutions which are purely sentimental or purely theoristic, the conclusions usually consist in finding a country which has been once wooded, but from which the forests have been removed, or one which was once open, but later became wooded. The climate at the beginning and end of the time involved is then ascertained or assumed, and the changes in the climate are attributed to the change of the forest cover. The uncertainties of this method are so great as to make it generally useless. It is seldom possible to be sure of the early forest condition of any particular country.—(M. W. Harrington, *op. cit*)

(*b*) *The case,* "*Forest Destruction* does *diminish the rainfall*":—

I think that the few authors about to be cited are fairly representative of the evidence that is usually adduced. There is a certain amount of vagueness in some cases as to whether it is intended to state that the amount of rainfall is diminished by the destruction of trees. My first illustration is given, because in one version or another it is so often quoted in the periodical discussions that have taken place in New South Wales.

The most fertile of all provinces in Bucharia was that of Sogd. Malte Brun said, in 1826:—

For eight days we may travel and not be out of one delicious garden.

In 1876, another writer says of the same region:—

Within thirty years this was one of the most fertile spots of Central Asia, a country which, when well wooded and watered, was a terrestrial paradise. But within the last twenty-five years a mania for clearing has seized upon the people, all the great forests have been cut away, and the little that remained was ravaged by fire during the civil war. The consequences followed quickly, and this country has been transformed into a kind of arid desert. The watercourses are dried up, and the irrigating canals are empty.

It is certain that the fertility of these regions in ancient times was due to stupendous irrigating devices and canals, and when these were neglected, through wars and other untoward circumstances, the fertility necessarily ceased. It is certain that there are ruins of enormous irrigating ditches and canals in Babylonia where history indicates that there were once a teeming population and great fertility, but where now only a sandy desert greets the eye.*

The late Sir William Hooker wrote:—

That from Ascension there continued to be received encouraging accounts of the increased fertility and moisture of the island consequent on the extension of the plantations.†

It is proper to point out that in this statement it is not asserted that the *rainfall* is alleged to have been increased.

It is remarked by Marsh, that "it has long been a popularly settled belief that vegetation and condensation and fall of atmospheric moisture are reciprocally necessary to each other, and even the poet sings of—

> Afric's barren sand,
> Where nought can grow, because it raineth not,
> And where no rain can fall to bless the land,
> Because nought grows there.

Here we have an illustration of the converse fact; one measure of humidity promoting vegetation, and vegetation not only arresting the desiccation, but so reversing the process that an increased humidity is the consequence.‡

While the extract just quoted may be interpreted as not stating that forests increase rainfall, the same work contains many instances (not well classified

* Professor H. A. Hazen before Annual Meeting of American Forestry Association, Nashville, Tenn., U.S.A., 22nd September, 1897; quoted in "Nature," 30th December, 1897, p. 213.

† Report of the Director of Kew Gardens for 1864.

‡ J. Croumbie Brown's "Forests and Moisture," pp. 144–5.

of the effects of the destruction of the forests and of varying degrees of value, but affording a lengthy list from which a writer working up a case can obtain his illustrations.

In connection with the systematic destruction of timber in Australia, it is mentioned that in the Ballarat district this destruction has been accompanied by a corresponding diminution in the rainfall, and since 1863 there has been a more or less regular reduction, from 37·27 inches in 1863 to 14·23 inches in 1868.*

This in inconclusive, for the reason that the years referred to may have been in a rainy cycle.

It is recorded of these (part of the Leeward Islands) that, in former times, they were clothed with dense forests, and the oldest inhabitants remembered when the rains were abundant and the hills and all uncultivated places were shaded by extensive groves. The *removal of the trees was certainly the cause of the evil.* The opening of the soil to the vertical sun rapidly dries up the moisture, and prevents the rain from sinking to the roots of plants. The rainy seasons in these climates are not continuous cloudy days, but successions of sudden showers with the sun shining hot in the intervals. Without shade upon the surface the water is rapidly exhaled, and the springs and streams diminish.†

See also a paper by the Rev. W. B. Clarke, M.A., F.R.S., on the "Effects of Forests Vegetation on Climate,"‡ which contains references to a number of authors, and which provoked an interesting discussion.

A pamphlet by Mr. F. S. Peppercorne§ gives a number of instances of countries whose present aridity is attributed to diminished rainfall, caused by extensive cutting-down of trees.

Aragua affords an interesting example of the evil influence of the wholesale destruction of trees in lessening running streams.||

J. Croumbie Brown (*op. cit.*, p. 112), gives additional information in regard to this interesting locality.

The Report of the Director of the Botanic Gardens of Adelaide for 1881 has an appendix on "The Influence of Forests on Climate," which mainly repeats the instances given in "The Forest" of Prof. Schacht.

Mr. J. G. O. Tepper, an earnest writer on philosophical questions pertaining to plant life, has a paper¶ which is well worthy of perusal. It enumerates a number of the oft-quoted examples of altered climatic conditions attributed to destruction of forests, and also deals with the problems of physics which are involved in a proper understanding of the subject.

(*c*) *The case,* "*Forest Destruction* does not *diminish rainfall*":—

With us forest destruction takes two forms:—

1. The felling, removal, and burning off necessary for agricultural and other settlement, and which many thinking men are of opinion is often carried out in too drastic a manner, to the detriment of the owner of the land himself, who often finds he has got rid of shelter and timber he would afterwards be glad of.

* "Nature," i, 261.
† Letter from Dr. Hooker to Lord Kimberley, 1870.
‡ Journal Royal Soc., N.S.W., 1876, 179 *et seq.*
§ "The Influence of Forests on Climate and Rainfall," Napier, N.Z., 1880.
|| J. M. Spence, "The Land of Bolivar," i, 159.
¶ "The Influence of Vegetation on Climate and Rainfall," read before the Royal Soc. of S.A., 3rd May, 1898 (printed by *Adelaide Observer*).

2. Ringbarking, which is necessary to fit much of our land for grazing purposes and which like (1) is undoubtedly done ignorantly and recklessly, particularly, I think, losing sight of the incipient creeks which are the beginnings of floods and washaways. This is a very wide question, which I have dealt with on a previous occasion (*ante*, June, 1905, page 540).

Our late Government Astronomer has given special attention to the "Forests and Rainfall" subject for many years, particularly with reference to Australia, and I cannot do better than quote some of his published statements.

Mr. Russell speaks,* in regard to forest destruction and climate, of "the tiny efforts of men" in the way of forest destruction, and the enormous quantity of felling and ringbarking that followed the Free Selection before Survey Act of 1861. He proceeds: "How is it that in India, where trees are conserved instead of destroyed, drought of extreme severity overtakes the country, and this too at times coincident with our droughts in Australia?" He also gives instances of droughts in the Pacific Islands and South Africa.

Mr. Russell formally reported on the subject, and his report was laid before Parliament on 30th November, 1898. He quotes the reports of the Meteorological Society of Edinburgh in 1859, in connection with the forests and rainfall question, which stated that "there were no grounds for thinking the rainfall of Western Europe was getting less." He adds:—

An elaborate investigation of the rainfall records by Mr Symons (the highest authority on such matters in England) had led to a similar conclusion. An investigation carried out in the United States by the Smithsonian Institution resulted in a decision that no evidence was to be found of a decreasing rainfall, and in America they had destroyed forests wholesale. Professor Marsh, in his book, "The Earth, as modified by Human Action," had discussed the question fully: and after considering all the available evidence, he concluded that there was no evidence that the annual rainfall had diminished by the action of man in the destruction of trees. Those parts of the State which had suffered most from the drought - Western Riverina and the Darling country—had done practically no ringbarking.

Mr. Russell adds:—

. . . . So far as New South Wales is concerned, he felt quite certain that the destruction of trees had not decreased the rainfall, but would rather appear to have increased it.† As an instance, the average rainfall over the whole Colony—1889 to 1894, inclusive—was 24 7 per cent. above the average of all years.

Mr. T. Kidston, a gentleman of much experience, states:-

I entirely dissent from the opinion that forest destruction diminishes rainfall. I have been through Upper and Lower Canada, Nova Scotia, and the New England States of North America, where the greatest amount of timber-cutting has taken place in the world's history in a like time, and yet the rainfall statistics show that during the last sixty years the rainfall has slowly, yet continuously, *risen*; and one of the most eminent meteorologists (Professor Marsh, from memory), after a life-long study, has recorded his opinion "that rainfall is not increased or diminished by anything that man has done, but by some great cause, *external to the earth.*" In this western‡ country, if ridden

* Letter to *Sydney Morning Herald*, 31st December, 1898. See also Hazen, *infra*, page 222.

† I have dealt with the subject of natural forest growths appearing without human agency in my Presidential Address, *Proc. Linn. Soc., N.S.W.*, 1902, p. 785, and would say that we have few data as to the net forest area in New South Wales, showing how forest destruction is balanced against planted and natural growth.

‡ "Ringbarking in Western New South Wales." *Agric. Gazette, N.S.W.*, November, 1894.

over a fortnight after a fall of 2 or 3 inches of rain, it will be found soft and boggy, if ringbarked; but the adjoining unringed country will be comparatively firm and sound. In the latter (green timbered country) the enormously increased evaporating surface of the leafage, compared with the area of the plot occupied by the tree, has carried the moisture off into the air, which is still retained in the soil among the dead ringbarked timber, and the grasses are nourished long after the soil among the live trees is parched and dry. The main cause of the water disappearing more rapidly from rolling or hilly country now than formerly is the solidification of the soil by the trampling of stock, more especially sheep. In Western Queensland, or any new country, before being stocked, the surface was soft and spongy, and a large part of the rainfall sank directly into the soil. Now, when trodden down and hardened by stock, the water more readily runs off, and so tends to form creeks and waterholes, which did not formerly exist. The sheep also trod into the damp soil the pine seed which formerly perished on the surface, or was swept into the rivers by heavy rains. Hardening the surface soil will account for the more rapid rise of floods and the greater erosion of river beds.

Mr. R. Wyndham writes*:—

The Hunter River Valley is now, generally speaking, all ringbarked, with the result that now dry creeks are running creeks, and dry gullies have waterholes in them. . . . . Before the valley was ringbarked the Hunter River was generally a chain of waterholes every summer; now it is always a running stream. I have no fear of ringbarking causing droughts, but I fear it will cause higher floods, as it stands to reason that creeks and gullies full of water cannot carry off the rain that dry creeks and gullies can. . . . To show how trees make the ground dry and hard, I may mention that I once gave a contract for fencing on ringbarked country where I had clumps of trees left for cattle camps. The fence went through one of these clumps, and the ground was so hard that the men had great difficulty in getting down their post-holes

The writer forgets to point out that cattle make ground very hard around shelter trees through trampling. The tramping of cattle, in its effects of hardening the soil, of forming tracks and incipient water-channels, breaking down the banks of watercourses and setting up new conditions, is a most important factor in connection with the conservation of water and the mitigation of floods.

* * * * * * * *

The question of ringbarking is a most important one in connection with my subject. I have already referred to it incidentally, and it is worthy of a little more emphasis in this place.

One writer says:—

Squatters know the value of shade too much to carry the practice (of ringbarking) to too great an extent

Another says:—

The number of persons who give the matter a second thought is very small.

I would ask, How many gentlemen in New South Wales have ever critically supervised ringbarking on their holdings? Is it not usually, "So many acres to ringbark; so much per acre"? Are important details connected with the topography of the land dealt with, or, in many cases, even thought of?

Most thoughtful men are of opinion that additional restrictions should be imposed on ringbarking on Crown lands. Mr. Inspector-Forester Manton† speaks very clearly as to the situation in the Murray River district.

* *Sydney Morning Herald*, 10th January, 1899.

† "Notes on Ringbarking and Sapping, based on Foresters' Reports." *Agric. Gazette, N.S.W.*, January, 1894.

I do not oppose ringbarking—it would be absurd to do so—for the effect on the grasses is not open to question, and trees are sometimes killed because they afford shelter for vermin ; but I am speaking of careless ringbarking. I repeat, without any fear of effective contradiction, that there is much room for more intelligent control of ringbarking in regard to the following points :—

1. Proper time to minimise suckering.
2. Valuable timber and shade trees should not be unnecessarily sacrificed.
3. The position of a tree with respect to the natural get-away of water in a particular paddock or mountain side should be considered.

It will be seen that in discussing the subject as to whether the destruction of forests does or does not diminish rainfall, the authors quoted do not always approach the subject in the same way. I proceed to give a quotation from Mr. Ribbentrop, one of the most eminent of living foresters, in which he shows, from his point of view, that it is not incorrect to state that destruction of forests *does* diminish rainfall. At the same time, it will be observed that Mr. Ribbentrop has refused to dissociate from the main question that of the local effects of the forest cover, which he has a perfect right to do. For the purposes of the present essay, I have endeavoured, for the sake of clearness, to enumerate issues somewhat in catalogue form, but that method may have the effect of leading a careless reader to forget that the subject of "rainfall and forests" possesses many ramifications, and a certain amount of repetition in dealing with the subject is unavoidable, and, perhaps, desirable, in order to emphasise various points of view.

There can be no doubt, whatever may be said to the contrary, that the widely-spread notion that forests tend to increase the rainfall, and that in a warm climate the denudation of a country diminishes its moisture, and, consequently, its fertility, is correct. As already pointed out, the theory is proved by history and ruins ; and the rapidity with which changes in the climate of different countries have taken place, entirely forbids that such sudden modifications should be ascribed to cosmic causes. We accept other scientific problems on much more flimsy evidence : but, in this instance, a large number of us suddenly swerve aside, and follow a school which starts new theories on partial observations, and leaves re-evaporation out of consideration. Ebermayer found, from experiments made, that during July, the hottest month in Bavaria, only 6 per cent. of the rain which fell percolated 2 feet deep into the ground in the open, against 61 per cent. which filtered down to the same depth in a forest, the ground of which was covered with complete and undisturbed vegetable mould.

In the one case, the water rapidly runs off into streams and seas by sudden floods and freshets, and this, too, when the whole atmosphere is surcharged with moisture. In the other instance, the water is stored for re-evaporation through the foliage of the forests, and is given forth at a time when the air is drier and the winds do not blow from the sea. It may be safely stated that more than half the rain which is thus stored in the ground is re-evaporated by the trees in time of need.*

3. The Vastness of Rainfall Conditions.

The quotations that I give should need no comment from me ; but I would draw attention to the point that, in Australia, to go no further, the fact that the conditions for a fall of rain may originate in a distant part of our planet

* "Forestry in British India," by B. Ribbentrop, C.I.E., 1900, p. 44.

is very imperfectly realised. I have travelled much in New South Wales, and I am sure that it would conduce to a better understanding of the subject by our people if they would lay to heart this fundamental and wide-reaching truth :—

When we reflect that our rain storms are of a very wide extent, sometimes over 1,000 miles in diameter, and may take their origin and bring their moisture from distances of 1,000 miles and more, the thought that man, by his puny efforts, may change their action, or modify it in any way, seems ridiculous in the extreme.*

Mr. Russell says† :—

The monsoons make or mar our climate. Given the monsoons full of moisture, and rain falls abundantly all over the State. If the monsoon wind is dry, it is also very strong, sending frequently and persistently strong hot nor'-westers, which bring no moisture, but dry up the country like veritable siroccos. Droughts are the result of special energy generated in equatorial regions, and distributed over the world by the trade winds and monsoons. The source of this energy, he thinks, is outside the earth ; but a full knowledge of it will not be obtained until all countries combine to trace the history of these destructive forces.

Professor Hazen has some further remarks that are pertinent in this connection ; and, as his paper is one of the ablest contributions to the subject that I have read, I would like to again quote him : —

It has been said that where our densest forests are found, that we have the greatest precipitation. There is no way whereby we can see that such forests would have started unless favoured by rainfall, so that the presence of the forest rather indicated the earlier occurrence of practically the same rainfall as at present. Meteorologists are agreed that there has been practically no change in the climate of the world since the earliest mention of such climates. . . . . When we come down to recent times, and to the records of rainfall measured in New England (U.S.A.) for more than one hundred years, or, at least, before and since the forests were cut, we find a constancy in the rainfall which shows its entire independence of man's efforts. Here it should be noted that totally barren lands of any extent—in New England, for example—are to be found only in imagination. Even where the forests have been cut away mercilessly there springs up a growth of sprouts which covers the ground, and answers almost the same purpose in causing rainfall (if there is any effect of that kind) as the forests. Even where land is entirely cleared of a forest, we have at times the green pasture, and at others still heavier crops, which leaves the soil anything but a sandy waste.

Professor Harrington, a learned meteorologist, also says : —

The facts to hand do not prove, with entire conviction, that forests increase the rainfall. The historical method is lacking generally in the character of the data for the beginning of the comparison. Besides, where a change of rainfall has been actually shown to be coincident with a change in the forest growth, it is not entirely certain that the former is due to the latter ; it may have been due to what are called secular changes of the rainfall, the reasons for which lie beyond our knowledge. The geographical method is not entirely satisfactory, for reasons already mentioned. The entirely convincing method depends on observations above forests, and with systems of radial stations, as proposed by Dr. Lorenz Liburnau ; and from these there is not a sufficient amount of published results.

Let me again quote Ribbentrop :—

Forests can have no influence whatever on the amount of moisture drawn from the ocean, and the general direction of the winds is unquestionably governed by greater causes. But, apart from this, periodical rains are subject to the same general laws as all other rains, and must, therefore, be affected by the same causes, and amongst them by extensive forest growth, in exactly the same way and degree. The air may be charged with moisture, which need not, however, be precipitated.‡

Let me quote the same author to again emphasise the point that, while it is indubitably true that rainfall conditions mainly originate many—very

* Hazen, *op. cit.*
† Report to Legislative Assembly, 31st November, 1898.
‡ *Op. cit.*, p. 45.

many—miles from the scene of deposit, it is simply impossible, and, indeed, undesirable, to lose sight of the local contributing effects of forests:—

The climate of each country and of each district is *primâ facie* dependent upon its geographical position, its elevation, the configuration of the ground, and other cosmic causes, which are independent of local circumstances. It can hardly be denied that the existence or non-existence of large well-wooded areas in a country naturally capable of growing forests, affects its climate in a very marked degree. History proves this to us in numerous instances where the deterioration of the climate of whole districts, and even of whole countries, has followed the destruction of forests.*

4. Clouds may strike against Trees, and deposit Moisture.

Trees cause a distribution of moisture from clouds where bare surfaces do not cause precipitation, but allow the clouds to roll on. A single large tree may mechanically hold, for a considerable time, a large quantity of water; and if this be multiplied indefinitely, as in a forest, an enormous quantity of water will be held or retarded. The effect of transpiration will be dealt with at page 888.

The following statement may be literally true, although the regularity of movement of the cloud referred to is remarkable; and with the size of the tree and the quantity of water rendered available we have nothing to do.

In an old work, mention is made of a celebrated tree in Ferro, which is said to have furnished drinkable water to the inhabitants of the island. According to the statement, every morning the sea breeze drove a cloud towards the wonderful tree, which attracted it to its huge top, and the water flowing from its foliage uninterruptedly, drop by drop, was collected in cisterns.†

Mr. J. Burtt Davy‡ speaks of the heavy summer sea-fogs, drifting high overhead across the narrow stretch of bluff land, which are intercepted in their course by the trees on the summits of the ridges; or, when they lie low, roll along the broad river valleys and more numerous canyons opening into the redwood forests, saturating the tree tops, and by their means also the soil below, with abundant moisture.

I again quote Professor Hazen:—

There is a class of visual observations which seem to show an effect upon rainfall by the forest. Probably many have seen heavy clouds pass over a plain, but which only precipitated as they passed over a forest; also, in a hilly region, it is a frequent phenomenon that fog and low-lying clouds hover near a forest, and not over an open plain. One also notes very often, in passing into a forest on a damp day, that the trees drip moisture, possibly condensed from the moisture evaporated from the damp earth underneath. Observations of this nature, however, cannot ordinarily be checked by instrumental means, but show in a general way that the forest tends to conserve moisture and vapour, which, in the case of the open field, would be diffused into the atmosphere.

I quote another American author:—

An illustration of the effect of trees on moisture condensation can be seen at and around Santa Monica. All along the nine miles of country roads planted with shade-trees by me, an investigator can now see green grass and verdure. Nowhere else on these plains is there anything green. The difference is due to the condensation by the trees of the evening fogs along the coast. When such occur, the trees dry the air and

* *Ib.*, p. 40.
† J. Croumbie Brown, *op. cit.*, p. 31.
‡ "Stock-ranges of North-western California."—Bulletin, U.S. Department of Agriculture (p. 12.)

moisten the soil. There is a regular drip of water from the foliage, and the seeds of the grasses and flowers have germinated and grown. The trees and brush on the mountain do the same thing. Anyone who has tramped through the brush on a foggy morning, or after clouds have rested on the mountains, knows that the condensed moisture on the chaparral* will wet him more thoroughly than a sharp rain.†

It does not rain all along the coast of Peru, for, say, 50 miles inland, from 28° S. to the equator, yet, during the months of May, June, July, August, September, every day, at 2 p.m. or thereabouts, there commences to fall a very heavy mist, wetting one through, if exposed to it, in a very short time. During those months all the sandy wastes are covered with a brilliant vegetation of flowers of various sorts. At the same time, these plains are covered with sheep, goats, cows, llamas, alpacas, mares, &c. No running streams of water are necessary, sufficient moisture being contained in the mists settling on the plants and flowers. The cattle and all the animals get fat during their stay on the "Lomas," as they are called. I was indebted to the late Mr. Charles Ledger, of "Cinchona Ledgeriana" fame, for the above particulars. He was long resident in Peru.

The deposition of moisture by means of trees is familiar to many of us in New South Wales. We have observed it in the forests covering the coastal escarpment; while the dripping of the trees from the "mountain mist" is a phenomenon very familiar to visitors to such of our mountain districts as are forest-covered.

I again quote Ribbentrop, even at the risk of some repetition in the present and past papers; but I desire, most earnestly, to emphasise the point that forests *conserve* rainfall.

The amount of rain depends on the extent of oceans and seas, on the degree of heat, and on the rapidity with which the air moves over the surface of the waters. None of these conditions are changed (he writes) by the extent or absence of forests. All air-currents blowing from the sea, are, year by year, charged with the same amount of moisture, which precipitates as soon as the air is cooled below the point of saturation. If such precipitation be caused by forests, the air currents reach the regions behind these forests drier and unable to yield a further supply of water.

"It is thus Oskar Peschel teaches in his well-known work *Neue Probleme der vergleichenden Erdkunde*; but he entirely omits from his calculation re-evaporation of moisture precipitated on the land, and his conclusions cannot, consequently, be accepted. A well-wooded forest area may be compared to a landlord who spends his income derived from the country within it, and for the benefit of his neighbours; whereas, cleared areas resemble absentee proprietors who scatter their revenues in foreign parts. It rains: the drops are scattered on the leaves, and fall in a soft gentle spray or in slow-falling big drops, which have collected on the foliage, on to the spongy forest ground. The water has thus time to percolate slowly into the soil below, whence a large quantity is gradually pumped up again through the roots of the forest trees, exhaled by their leaves, and again assists in forming rain-clouds. Wooded areas, no doubt, extract, under the same circumstances,

* Chaparral is the Spanish word for a thicket of low shrubs, and was used by the Spanish-Californians to designate the thickets of scrub-oak (*Quercus dumosa*) which are so noticeable a feature in the rocky ridges of this region It is now applied promiscuously to any dense brush of prickly or rigid shrubs growing on similar situations, as well as to the individual species of which the mass is composed.—"Stock-ranges of North-western California," J. B. Davy, p. 31.

† "Forestry in California," by Abbot Kinney.

more moisture out of the air than disforested regions; but they serve as a storehouse, and yield again what they take; whereas, a great portion of the water precipitated on barren soil is only recovered by evaporation from rivers, lakes, and oceans. Forests use, therefore, much less moisture than barren areas in the same position and under similar conditions, and augment the atmospheric moisture in regard to regions which are separated by such forests from the sea, instead of diminishing it. Their action in this respect is not the same as that of an intervening mountain range."*

5. Not merely a question of large trees.

When one speaks of the effects of the destruction of vegetation on the climate, it is a common error to assume that trees (forest trees) are alone referred to. As far as the western country is concerned, the number of trees available for ringbarking has at all times been insignificant in comparison with the coastal country and Dividing Range; in other words, they were not there to ringbark. But there has been much vegetation of a smaller kind, and it is believed by many that the eating-out and burning over of much of this vegetation is responsible to some extent for the changed condition of the western country to-day.

The problem for New South Wales is to make the very best use of the water we receive, to keep it as long as we possibly can, and the encouragement of vegetable growth is a factor which tends to enable us to do this.

The main forest covering of the mountains of Southern California consists of chaparral and brush. This covering holds the soil on the steep mountain sides, and detains the rainfall delivery, so that time is given for it to percolate into the water-veins and natural reservoirs. Where these water-sheds are burned over, the importance of the forest covering is at once demonstrated. In such districts the destructive force of the floods increase . . . . The rainfall is thus suddenly delivered to the injury of all. On the other hand, the perennial character of springs and streams is diminished or destroyed . . . . When the forest is gone on these steep sierras, floods and torrents alternate with wide and arid wastes of waterless torrent beds.†

6. Rainfall Measurements in Forests and open Country.

We have large areas in this and neighbouring colonies where the forest is so thick that it will not pay to clear it away. Yet these very rain traps secure no more than the bare country, as I know by actual experiment carried on in one forest for a number of years, and in the dry time they suffer from drought just as the bare country does.‡

But the strongest argument adduced in the past to show the influence of forest on rainfall has existed is a comparison between rain-gauge measures in the forest and in the open field. Such records have been made for more than thirty years in France and Germany, and surely we must have here, if anywhere, a sufficient proof of a forest's influence.

Admitting that we have perfect instruments and careful observers, there still remains a most serious doubt as to the immediate environment of each gauge, and as to the possibility of a direct comparison. It is probable that no two gauges 2,000 feet apart can be placed so as to catch the same amount of rain, though to all appearances the exposure is faultless in each case. §

Extreme caution is, therefore, needed in interpreting rainfall records in forests. We have also evidence of the partiality of rain showers on similar

* *Op. cit.*, p. 41.
† Abbot Kinney, *op. cit.* See also article IX of this series, *Gazette* of June, 1905.
‡ Mr. H. C. Russell, *Sydney Morning Herald*, 1st December, 1898.
§ Professor H. A. Hazen, *op. cit.*

surfaces—*e.g.*, it sometimes rains in one paddock and not in an adjacent one. Professor Hazen gives instances of accurate records in forests and adjacent country by meteorologists, both in France and Germany, and shows the inconclusiveness of the results. Croumbie Brown, in his "Forests and Rainfall," also gives a full account of these researches, which cannot be further alluded to in detail here.

Let me, however, point out that the humidity of a forest is not entirely a matter of rain-gauge measurements. I think, in order to thoroughly test this aspect of the question, the hygrometric state of the atmosphere in various places, whether carrying forests or other vegetation, and whether denuded by the hand of man or not, should be ascertained and compared for a series of years. The districts should be as numerous as possible, but we should not limit the observations to rain which can be measured in a rain-gauge. It will be found that much of the moisture which goes to assist plant growth and to modify climate is not measured by such a crude instrument as that referred to.

Those who desire further information on the subject are recommended to read the chapter "Rainfall in, above, and near Forests," by M. W. Harrington, at p. 106 of the work "Forest Influences," already quoted.

7. Physiological Action of Trees.—Transpiration.

Another phase of the conservation of water by trees is the question of transpiration. This is the technical word for what may be described as the perspiration of plants. The tree absorbs moisture by its roots, which is utilised to continue the functions of the plant, and a portion of it is exhaled in the form of vapour by each leaf, and passes into the atmosphere. The effect of a single tree is a very large multiple of that of a single leaf, and that of a forest is similarly greater than that of a single tree. This emission of vapour by plants is more or less fully dealt with in all works on vegetable physiology. In this way a forest has an appreciable effect on the humidity of the atmosphere, and this is one of the reasons why, on the ground of transpiration alone, the atmosphere of a forest is moister than that immediately above the surrounding land, and it is desirable to conserve the forest growth on that account.

Botanists have made many measurements of its amount, and their results are extremely varied, due partly to the fact that this function varies much naturally, and still more to the fact that experiments are generally made under conditions which are not natural to the plant. Sachs says that it is no rarity for a tolerably vigorous tobacco-plant at the time of flowering, or a sunflower the height of a man, or a gourd-plant with from fifteen to twenty large leaves, to transpire from 1 to 2 pints of water on a warm summer day, and so far as may be judged by the use of branches with the cut end in water, it may be believed that large fruit-trees, oaks or poplars, absorb, transport through their stems, and transpire through their leaves, 10 to 20 or more gallons of water daily. It is not generally practicable to compare the transpiration with known meteorological phenomena, such as evaporation.

from a water surface, or from the soil, or the precipitation, but some such comparisons have been made For instance, comparing the leaf surface to an equivalent water surface, Unger makes transpiration from the former 0·33 of the evaporation from the latter; Sachs, for white poplar, 0·36, the sunflower 0·42. Comparisons have also been made between the transpiration from plants and from the evaporation from the surface over which the plants stand. Schleiden thought that the transpiration from the forest was three times that of the water surface equal to the territory covered by the forest; Schübler thought it only a quarter; and Pfaff, who studied a solitary oak in a garden, found that it varied from 0·87 to 1·58. Comparing the transpiration of plants with the evaporation of the bare soil which would be covered by them, Hartig thought the transpiration of a forest less, Schübler found it 0·6 for the forest and 3·0 to 5·0 for the sod. Marie-Davy found it for firs 1·18, for beeches 1·32, for sod 1·86.

The quantity of water so used is as variable as the amount of precipitation, and, in fact, within certain limits depends largely upon it. That is to say, a plant will transpire in proportion to the amount of water which is at its disposal. Transpiration is also dependent on the stage of development of the plant, on the nature of its leaves, and the amount of its foliage, on temperature, humidity, and circulation of the air, on the intensity of the sunlight, and on temperature and structure of the soil and other meteorological conditions. Rain and dew reduce the transpiration, wind increases it. The amount of transpiration depends considerably on the thickness of the leaves, therefore the surface of the foliage is not a reliable measure, but should be compared with the weight. With so many factors to vary them, the values which may be given for the amount of transpiration of various kinds of trees can only be approximations of its range within wide limits. (Harrington, *op. cit.*)

All vegetation takes up a certain amount of water, a part of which is consumed in building up its body, and a still larger part returned to the atmosphere by transpiration during the growth.

The factor of dissipation having been fully discussed, it need not be further considered here, except to recall the conclusion that forest growth transpires considerably less than other kinds of vegetation.

Since this water is given off again to the atmosphere in the locality where it has fallen—thus enriching the atmospheric moisture—and is, therefore, only diverted temporarily for the purpose of doing duty in producing useful substance and retaining it in the locality where it has fallen for a longer time, transpiration may even be considered as an element of conservation.

There is still to be considered a certain amount of moisture which is retained and stored up in the body of the plant, partly as a necessary permanent constituent, partly as a temporary constituent, being evaporated when the plant dies or the wood is seasoned. The amounts thus retained vary considerably according to age, capacity for transpiration, site, soil, climate, density, slow or rapid growth, weather, seasons, and even the time of day. It is, therefore, almost impossible to give anything but very rough approximations,

especially as also the different parts of the tree vary considerably in the amounts of water present. (Fernow, *op. cit.*)

8. Some Uses of Forests.

(*a*) *To temper Floods.*

I have dealt with this subject in a former paper,* hence I propose to give more cursory treatment in this place than its importance demands. I think very few men will dispute the use of forests in mitigating the effects of downpours of rain in regard to the flow of watercourses.

The effects of forests in retarding the flow of the rainfall after its precipitation has been established, I consider, beyond all question.†

Already the rivers that rise in those regions (Northern United States) flow with diminished currents in dry seasons, and with augmented volumes of water after heavy rains. They bring down larger quantities of sediment, and the increasing obstructions to the navigation of the Hudson, which are extending themselves down the channel in proportion as the fields are encroaching on the forests, give good grounds for the fear of irreparable injury to the commerce of the important towns on the upper waters of that river; unless measures are taken to prevent the expansion o the improvements, which have already been carried beyond the limits of a wise economy.‡

Professor Fernow says :—

The present policy of forest destruction and of allowing our waters to run to waste, not only entails the loss of their beneficial action upon plant production, but permits them to injure crops, to wash the fertile mould from the soil, and even to erase and carry away the soil itself.

And again :—

Here the comparative lengths of the affluents alone may become all important, since the simultaneous or non-simultaneous arrival of flood-waters may determine the occurrence or non-occurrence of floods As far as the forest cover is concerned in such cases, deforestation in one side of the valleys and consequent rapid discharge, may become an advantage for the water to flow in the main river, by allowing its removal before the arrival of the flood-waters of another affluent. In view of these considerations it would, therefore, be folly to assign to the conditions of the forest cover in the catchment basins an all-determinative function. Nevertheless, in general, the influence of favourable forest conditions in the catchment basin upon river flow cannot be doubted, although it may become practically of no account in abnormal floods. . . . In the torrent of Bourget, which had been reforested and corrected in its bed, a simple, somewhat turbulent run of water was observed, which at the overflow reached the height of 45 centimetres (18 inches), and lasted about three hours.

The report thus continues :—

The facts show the importance of the forest cover. Thanks to the dense growth planted, the flood-waters, divided in numberless runs and retarded constantly in their movement over the declivities in the upper basin, arrive only successively and little by little in the main bed, instead of these formidable masses of water and *debris* which, rapidly agglomerated, rush into the channel; the brooks called to replace the torrent receive only pure water; flood-waters flowing off gradually and made harmless by the regulation of the torrent bed and of the slopes.

Let me make three quotations from Ribbentrop :—

The Ratnagiri District, in the Bombay Presidency, is almost bare up to the crest of the Ghâts, and here, Sir Dietrich Brandis says, the effects of denudation have shown themselves in this way :—

There are four principal streams in the district, which, rising in the Ghât mountains, run a short course to the sea, all of which were formerly navigable and important for the trade of the country. For small boats they are still navigable, but they are gradually silting-up, because the hills at their head-waters have become denuded of forests.§

* "The Mitigation of Floods by Forestry Operations," *ante Gazette* for June, 1905, p. 535.
† J. Croumbie Brown, *op. cit.* ‡ Peppercorne, *op. cit.* § *Op. cit.*, p. 52

The denudation of the Deccan highlands and the Eastern Ghâts has resulted in the gradual silting-up of rivers. When the English, French, and Dutch first made settlements on the Coromandel Coast, they were able to take ships up the rivers Godavari and Kistna. Narasapur (English) and Yanaon (French), on the Godavari, though now only approachable by small native crafts at high tide, were once the chief ports for that part of the coast. At Masulipatam, the Dutch ships used to come close up to the fort, but now even native vessels of small draught have to anchor 5 miles out in the roads.*

The periodically recurring breaches in the railway embankments, especially those of July, 1866, are, there is good reason to believe, due to the denudation of the Sewaliks and other sub-Himalayan hills.†

I do not know to what extent the silting-up of our rivers, owing to the washing away of the soil on their banks and on higher levels, has been studied in New South Wales, but undoubtedly it is a subject worthy of the attention of our best intellects.

Take the case of the Hawkesbury River, which comes to my mind as I write. Everyone knows that in the "early days" this river was navigable

Windsor in 1813.

as far as Windsor for fairly large craft, but the navigation of the river to any but the smallest boats has long been impossible. Why? Simply because the river has silted-up? What has caused the silting? In my view, the indiscriminate cutting down of the forests in the watershed of the Hawkesbury, and the cultivation of the land too close to the banks of the Hawkesbury and its tributary streams. The quantity of silt that comes down the river, even by a "fresh," is surprising. Much of this is deposited in the bed of the river, and does not pass out to sea. The same remarks apply to the Hunter and other rivers. I am fully aware that much of this cutting down of forests and cultivation are quite unavoidable; but I also assert, without fear of effective contradiction, that much of this cutting down of trees and clearing

* Op. cit., p. 52. † Op. cit., p. 54.

away of vegetation, and also this greedy cultivation of land towards the margin of streams and in the line of washaways, is the result of cupidity and ignorance, and must result in national impoverishment as certainly as the night follows the day.

Last year a meeting of the International Navigation Congress was held at Milan, Italy.

One of the questions taken into consideration was "the influence which the destruction of forests and desiccation of marshes has upon the *régime* and discharge of rivers," and seven papers bearing upon the subject were read and discussed. Of these, three were from Austria, and the others from Germany, France, and Russia. The problem as to the effect of forests on the water supply of rivers and of climate is of great social importance, on account of the agricultural and commercial interests which are so closely connected with the use of timber, and with the utilisation of running water. It is allowed by all the authors of these papers that, due to the improvident way in which the forests have been dealt with, there has been marked change in the water supply of the neighbouring rivers; that where forests have been cut down brooks have disappeared, and many small rivers that at one time were useful as sources of power are so no longer for want of water; that in the larger rivers torrents have become more impetuous and flooding more frequent, while, on the other hand, navigation suffers at times for want of water.

The greatest harm has been done in the mountain districts, where the steep slopes allow the rain-water to run off too rapidly, carrying away the surface soil and transporting pebbles and boulders into the rivers, causing shoals, and thus decreasing their capacity to discharge the flood-water. The extent to which forests, both on the Continent and in America, are being cut down and destroyed, and large areas of land, which at one time were covered with primaeval forest, have become barren waste by fire or the lumberman's axe, without any attempt at reafforestation, was one of the subjects dealt with in the presidential address of Mr. J. C. Hawkshaw, at the Institute of Civil Engineers, in 1902. . . . .

The question for consideration at the Congress was whether the wholesale destruction of forest land for cultivation or for timber supply is having any material effect on the rainfall and consequent water supply; and the effect of forest destruction on the rivers of the country from which the trees are removed was also considered. The physical conditions of forest land are that, owing to the shelter from sun and wind, the atmosphere is generally colder and damper than in the open country, and evaporation consequently less. It is calculated that a hectare of forest land ($2\frac{1}{2}$ acres) gives off every day 37 cubic metres of oxygen and 37 metres of carbonic acid, leading to a great expenditure of heat; and that from every hectare of forest land sufficient heat is abstracted to melt 316 cubic metres of ice. Ligneous plants also withdraw from the ground and discharge as vapour more than 40,000 gallons of water per hectare per day, which causes a sensible reduction of temperature. When clouds pass over a forest they encounter a cool, damp atmosphere, the point of saturation comes closer, and rain is caused. This condition of forest land has been remarked on by aeronauts, who find that a balloon is invariably affected, and drops when passing over forests. . . . .

On the other hand, it has been contended by some of those who have made a study of sylviculture that forests do not increase the quantity of water flowing to the springs and rivers, but reduce it. The numerous striking facts quoted do not bear out this contention, which is mainly based on the fact that the substratum water stands at a lower level on forest land than on the adjacent cleared ground. The fact is generally to be admitted to be the case at one period of the year. As the result of many years' observations, it has been found that the maximum level of underground water is reached in May, that the water accumulates in the ground from August to January, and that the rivers are supplied by this reserve; and were it not for this accumulation many brooks and river feeders would cease to flow in summer.

Several very striking examples are given by the authors of the papers as to the deleterious effect of cutting down forests, especially in hilly districts. In the commune of La Bruguière the forests on the slopes of the Black Mountain were cut down; the consequence of this removal of the trees was that a brook which ran at the foot, and the water from which was used for driving some fulling-mills, became so dried up in summer as no longer to be of any use, while in winter the sudden floods caused very great damage in the valley. The forests were replanted, and as the trees grew up the water coming to the brook was so regulated as to serve its former useful purpose in driving the mills, and and the torrents were moderated. Several other examples of a similar character are given. In Switzerland, amongst other examples, is quoted one that occurred in the canton of Berne, where, owing to the replanting of the mountain side with fir-trees, the

water again appeared at a spring which had ceased to flow. After a period the trees were cut down, and the land converted into pasturage, since when the spring has almost disappeared, only opening out at occasional intervals.

In the Kazan district of Russia, once celebrated for its forests of oaks and linden, which are now nearly all cut down, there were formerly seventy water-mills constantly at work. Less than half now can be worked, and even they only run half-time, and are idle in summer for want of water, while in winter the little rivers that worked these mills are converted into impetuous torrents, breaking up the mill-dams, and doing other damage. These abandoned water-mills stand out as a standing proof of the consequences of the destruction of forests. In Sardinia, where the surface consists of plutonic rocks, with a thin layer of earth, all the streams have a rapid slope. The woods, which occupied in 1870 an area of more than two-and-a-half million acres, or about 43 per cent. of the whole surface of the island, now are reduced to about one-sixteenth of this area. Since the removal of the trees, the floods in the rivers rise with a rapidity and flow with a velocity never known before, and a great number of bridges have been destroyed by the floods. The beds of the channels have been raised in some places above the surface of the land, owing to the *detritus* brought down in floods

In Wisconsin, U.S.A., the settlers cut down the forests, and converted the land into tillage and pasture. During a period of about seventy years nearly the whole of the forest land was thus cleared, with the result that, as the forest disappeared, the water in the river became lower. Finally, 30 miles of the channel entirely dried up, and many water-mills that were formerly worked by the stream are now deserted and useless, owing to the want of water to run them. In Sicily, owing to the cutting down of the forests on a vast scale in the province of Messina, the bed of the river has been raised by the stones and earth carried down by the torrents so as to stop all drainage from the land, and great damage has been done by the floods. Several other examples are given to the same effect where forests have been cleared in the same district; and these are compared with other streams where the forests still exist, and their condition remains unaltered. In the former case, land-slides from the mountains have become very frequent.*

(*b*) *To conserve Springs, and to aid in the more even distribution of Terrestrial Waters.*

These subjects are intimately associated with the preceding, the necessity for the tempering of the floods being only an extreme case of the conservation and distribution of water.

Under the forest shade, the soil is in a state of perpetual increment from the humus afforded by decaying foliage, and trunks and roots hold it together; the branches break the violence of the rainfall; the spongy absorbent nature of the soil enables it to retain it; and this, slowly sinking into the underlying rock, preserves the needful moisture in the soil, and becomes the source of perennial springs. But if such a mountain forest be suddenly laid low, we have not only to fear the appearance of an undergrowth prejudicial to tree reproduction, but we have to fear the total loss of the soil, which, exposed to the violence of the falling rain and no longer held together by the tree-roots, gets washed down into the valley below, until the bared subsoil or rock is unfitted for the support of any but the scantiest herbage.†

And again :—

It has been well established that forests have a most important bearing upon the conservation of rainfall; that the forest floor permits a seepage of water to the source of springs, and thus maintains their steady flow; that they hold back the precipitation that falls, especially in the form of snow, thus preventing or ameliorating the effects of dangerous freshets. There is not the slightest doubt of their great importance to the welfare of man, but all these facts do not affect the question of their influence upon precipitation.‡ Two years' observations are insufficient to show any definite variation in the annual average of the quantity of rain. But, so far as they go, they show that at Marmato the mass of running water had diminished in spite of the larger quantity of rain which fell. It is therefore probable that local clearings of forest land, even of very moderate extent, cause springs and rivulets to shrink and even to disappear, without the effect being ascribable to any diminution in the amount of rain that falls.§

* *Agric. Journal, Cape of Good Hope*, May, 1906, pp. 613–615.
† Amery, "Notes on Forestry," p. 12.
‡ H. A. Hazen, *op. cit.*
§ Boussingault, quoted by J. Croumbie Brown, *op. cit.*

It is an almost universal and, I believe, well-founded opinion, that the protection afforded by the forest against the escape of moisture from its soil by superficial flow and evaporation, ensures the permanence and regularity of natural springs, not only within the limits of the woods, but at some distance beyond its borders, and thus contributes to the supply of an element essential to both animal and vegetable life. As the forests are destroyed, the springs which flowed from the woods, and, consequently, the greater watercourses fed by them, diminish both in number and volume.*

Some other references to various authorities incidentally touch upon the effects of forests on the flow of springs.

I will take further examples in our own State, quoting some that are of especial interest to us at this time, because they are on the catchment area of the Sydney Water Supply. There are places on slopes, *e.g.*, at Cordeaux River and East Kangaloon (*e.g.*, the properties of Messrs. Brooker and Kirkland), in which there were intermittently dry creek-beds before the arrival of the white man. Since the felling of trees has taken place from the vicinity of the creek-bed, a permanent water supply has resulted. In fact, in one case in which there was no creek at all within human knowledge, the selector has had to provide himself with a small bridge.

Again, the Cataract River rises on Mount Keira in densely timbered country—the Coast Range, where there is a rainfall of (say) 60 inches, yet this is an intermittent stream. On the other hand, the Cordeaux River, which rises at the back of Mount Kembla, further south, is more sparsely timbered, and has been cleared up to nearly the head of the river, yet it never ceases to flow. It is also in country with less average rainfall than the preceding.

Mr. Harris, the Ranger of the Catchment Area, informed me that there are two tributaries running into the Cordeaux River on its left bank, viz., Sandy Creek and Wattle Creek. The former, perhaps, drains a larger area than the latter. Sandy Creek is well timbered; Wattle Creek is sparsely timbered. During the drought of (say) 1900-2 Sandy Creek ceased to flow, while Wattle Creek was still running. He is emphatic in attributing this increased flow to the denudation of the timber, stating that the trees transpire or absorb the water which is dissipated into the atmosphere.

I have found that a spring in the parish of Dulladerry, about 2 miles from Meramburn Railway Station, went dry during the drought of 1884, but has given no indication of failure during the recent dry weather. Since 1884 the country from whence it derives its waters has been ringbarked. Observant, practical men asserted several years since that the spring would not go dry, as the basin of the creek in which the creek is situated is ringbarked. Their prediction has proved true.†

In this case it may have been that the absorption and transpiration of the water by the trees is greater than by the grass which increased in the ringbarked country. It seems like an argument in favour of cutting down forest trees to improve the moisture conditions of the country. Or it may have been that the rain ran off this particular area of country as a forest, or scattered forest, more rapidly than when the surface was covered with grass. The question of conservation of moisture is many sided, and must be considered in all its bearings in order to form just conclusions.

* J. Croumbie Brown, *op. cit.*, page 167.
† Mr. James Anderson in *Sydney Morning Herald*, 10th January, 1889.

To say that the regular and permanent flow of the streams is owing to the felling of trees is easy, but to explain the causes is difficult. I have already stated that the natural forest growth retards the flow of the water, and hence tempers floods. The continued cutting of trees may cause the flow to be regular under normal (*i.e.*, non-flood) conditions. What is the cause? Is it transpiration? I think there is still much room for research on the subject, for some of the statements appear to be absolutely contradictory at first sight.

We have very few data of practical value not only in regard to transpiration but also in regard to absorption. We have many laboratory results, but these inductively applied to a congeries of roots, or a congeries of leaves forming a forest, produce in many cases absurd results. For example, we have results when worked out which show that a gum-tree absorbs and transpires incredible quantities of moisture, figures which literally make one's mouth water in this thirsty land.

Professor Fernow gives a remarkable illustration of the difficulties that surround attempts at quantitative determinations of hydrographic investigations of a watershed. For example, the amount of annual discharge of the River Rhone corresponds to a rainfall of 44 inches over the watershed, while the rainfall records themselves for a certain period give a precipitation of only 27·6 inches. Truly meteorological and kindred data require to be interpreted by experts. Professor Fernow makes the suggestive statement:—

> The water capital of the earth consists of two parts, the fixed capital and the circulating capital. The first is represented not only in the waters of the earth, but also in the amount of water which remains suspended in the atmosphere, being part of the original atmospheric water masses which, after the rest had fallen to the cooled earth, remained suspended and is never precipitated. The circulating water capital is that part which is evaporated from water surfaces, from the soil, from vegetation, and which, after being temporarily held by the atmosphere in quantities locally varying according to the variations in temperature. is returned again to the earth by precipitation in rain, snow, and dew. There it is evaporated again either immediately or after having percolated through the soil and been retained for a shorter or longer time before being returned to the surface, or, without such percolation, it runs through open channels to the rivers and seas, continually returning in part into the atmosphere by evaporation. Practically, then, the total amount of water capital remains constant; only one part of it—the circulating capital—changes in varying quantities its location, and is of interest to us more with reference to its local distribution and the channels by which it becomes available for human use and vegetation than with reference to its practically unchanged total quantity.

(*c*) *To prevent evaporation of water.*

In the Journal of the Royal Agricultural Society, New Series, vol. ii, page 110, there is a statement by Mr. R. Orlebar, of Wellingborough, on the advantage of planting trees around ponds, in which he says:—

> It is astonishing what effect a little shade has in checking evaporation. A pond that is well shaded will hold water for weeks after one of equal dimensions, but lacking shade, will become dry.*

This is a matter of considerable importance to us, as in most parts of the country the conservation of water is the first consideration. Officers having control of roads are usually very particular, where the road is at all damp, to cut down the trees by the side of it, in order that the sun and wind may play

* Brown, *op. cit.*, page 55.

upon the road and dry it up. It is quite true that trees by the side of water absorb some of it during the process of growth and emit it into the atmosphere by the process of transpiration, as I have already stated, but as a very general rule, it would effect economy in water if dams and other receptacles for water were surrounded by a thick belt of trees. The question of diminution of evaporation should always be considered in cutting down trees from the vicinity of any stagnant or flowing water in this country.

The matter of shade is stated in another way when we draw attention to the fact that clumps of trees or forests prevent desiccation of the ground—the forest floor.

(*d*) *To give shelter for stock, crops, &c.*

This is a mechanical action of forests, and their value in that respect is so evident as not to be open to argument.

Professor M. W. Harrington (*op. cit.*, pages 23-4) says that the forest is to be considered, in its effects on climate and weather, as a special form of surface covering. Its effects are of the same order as those produced by a covering of sand, or sod, or water, but the forest effect has some peculiar features which are due to the fact that the covering is elevated to some extent above the soil. This imparts to the soil in some degree the climatic characteristics due to a topographical elevation, and also causes a series of wind-break effects which are not found with the other forms of surface covering. On account of this distinctive feature, the problem of forest climatology separates into two problems, which must be considered each by itself. The one relates to the climate of the interior of the forest, and the other to the effects of the forest on the climate of the country around it. The two are quite different: the first is of relatively little importance, except as it relates to the second. It is the second which is of interest and importance, so far as relates to the suitability of a climate for residence and agriculture. The same authority, at page 118 (chapter "Forest, Wind and Storms"), speaks at greater length on the wind-break question.

(*e*) *The leaves of forest trees afford manure and mulch.*

This is less evident in the dry country than in the well-watered coast belt and coastal mountain ranges, and is of less importance in Australia, where trees are mainly non-deciduous as regards their leaves. But the matter is one of extent rather than principle, for we have *débris* of all kinds from living trees, consisting not only of leaves, but of flowers and fruit, limbs and trees, and, as regards our Eucalyptus forests, a large percentage of naturally shed foliaceous bark. All this serves as a manure and mulch to the forest floor, and thus the evaporation of the moisture is diminished.

Mr. Marsh speaks of the ever-renewed and increasing vegetable mould as a perpetual *mulch*, and in reference to the humidity of forest soil he cites the following passage from "Etudes sur l'Economie Forestière," by Jules Clave:—

Why go so far for the proof of a phenomenon which is repeated every day under our own eyes, and of which every Parisian may convince himself without venturing beyond the Bois de Bologne, or the forest of Meudon? Let him, after a few rainy days, pass along the Chevreuse Road, which is bordered on the right by the wood and on the left

by cultivated fields. The fall of water and the continuance of the rain have been the same on both sides; but the ditch on the side of the forest will remain filled with water, proceeding from infiltration through the wooded soil, long after the other, contiguous to the open ground, has performed its office of drainage and become dry. The ditch on the left will have discharged in a few hours a quantity of water which the ditch on the right requires several days to receive and carry down to the valley, and, but for this drainage into the ditch, the water might have remained there for an indefinitely longer time.

Speaking of the forest floor, irrespective of a leaf-mulch surface, Professor Harrington quotes Fesca to the effect that the downward movement proceeds quickest in a dry dust, only slowly in clay soils, the same amount of water being drained through the former in one hour which took two days to drain through the latter, and emphasises the point that the surface conditions of the soil of a watershed are the only controllable factors in the problem.

The necessity of preserving the dead leaves to form humus should be strongly insisted on. It has been proved by Grandeau and Henry, two of the Nancy professors, that besides serving as food for earth-worms and other organisms, the activity of which keeps the soil porous, friable, and superficially rich in nutritive mineral matter, dead leaves fix atmospheric nitrogen to the extent of 12-20 lb. per acre annually. To deprive a forest of its dead leaves is like robbing a farm of its dung.

It may be argued that evaporation from open ground is much more intense than from soil covered by forests. No doubt this is the case, and Ebermayer, in his "Die Physikalishen Einwirkungen des Waldes auf Luft und Boden," gives the following data :-

The forest alone, without the cover of dead leaves, diminishes the evaporation by 62 per cent., as compared with that in the open. Evaporation is, consequently, 2 6 times less in the forests. A covering of dead leaves and vegetable mould diminishes evaporation by a further 22 per cent.

Forests with an undisturbed covering of dead leaves and vegetable mould lessen the evaporation as compared with that in the open by 84 per cent

These data are based on observations made in Bavaria during the summer months. In the Indian climate the difference, which increases in proportion to the heat and dryness of the atmosphere, would be even more considerable.*

I now submit the whole subject for consideration of the readers of the *Gazette*. The matter of forest meteorology, and the questions that crop out of it, present many puzzling problems to us in Australia, and some of them have as yet baffled the meteorologists of long settled countries. A proper understanding of the principles which underlie the relations of forests and moisture is of interest to us in two special ways: first, as regards the water supply of a large city (Sydney), and, secondly, as regards the distribution and conservation of moisture over the whole of the State. Reasonable expenditure for research would be justifiable, if we could be thereby placed in a position to deal less empirically with the rainfall we receive, and to know how to conserve it more wisely than we do at present. A certain amount of rain falls upon New South Wales. Do we take care that it will do us most good, and remain with us, benefiting us as long as possible? Many public questions that loom large in the public eye should really claim less of our attention than this.

(To be continued)

* Ribbentrop, *op. cit.*, p. 43.

Ensilage Making from Native Grasses and Herbage.

JOHN GRAY,
Glencoe, Wee Waa.

THE two essential factors for the successful settlement of the rich pastoral country in the west and the north-west of the Central Division of the State, are permanent supply of water and feed for stock in time of drought.

The water difficulty has been solved by the discovery that the artesian belt underlies the whole of this part of the State, and that it is only a question of sinking sufficient bores and distributing the water therefrom, for every settler to have his land permanently watered - a work which is being rapidly pushed forward by the Government.

The feed difficulty is, however, still a most serious one, for although feed for the flocks and herds may be grown by irrigating land with bore or other water, the question which lies at the bottom of the whole matter is, "Can one make it pay?" The practical man says "No." (See *Gazette*, August, 1906, p. 780.)

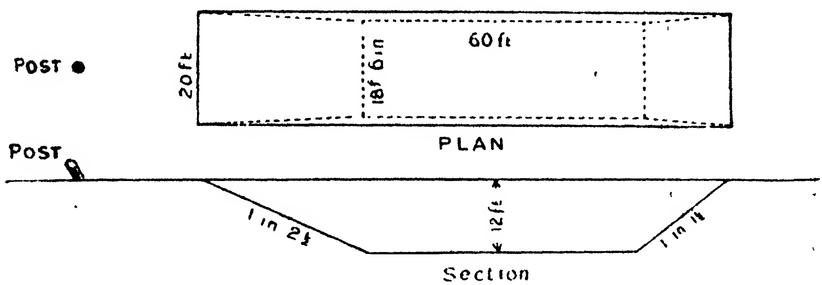
I am the owner of 1,800 acres near Wee Waa, known as Glencoe, and have been experimenting for the last seventeen years thereon, trying to find a cheap and effective manner of preserving the natural feed which grows so luxuriantly in a good season all over our rich pastoral lands. The result of my experience is that I can and do now produce ensilage at a cost of about 2s. (two shillings) a ton at the pit. My friends have been urging me to make known the method adopted in order that other settlers may have the benefit of my experience. Believing that sheep-farmers and stock-owners would like to have a plain statement of how natural feed can be conserved at such a low cost, I have acceded to their request.

The method I have finally adopted is that of the "pit"; the "tub" system means too much cost in handling, while the "stack" method, though not so costly in handling as the "tub" system, is still too expensive, and in addition the waste is too great.

Site for pit, size, &c.

The main consideration in this matter is that the place selected should have a non-porous subsoil. To make sure of this it would be advisable to sink a trial shaft to a depth of 12 feet. The place should be above flood-level if convenient, but provided it is not in a swamp, any place with the requisite subsoil will answer, as part of the earth taken from the pit can, in country liable to inundation, be deposited in a bank round the pit, say, 40 feet to 50 feet distant, so as to prevent flood-water entering, and at the same time leave plenty of room to work drays between the bank and edge of pit. A good size for the pit is 108 feet long by 20 feet wide (surface measurement), 60 feet long by 18 feet 6 inches wide (bottom measurement), and

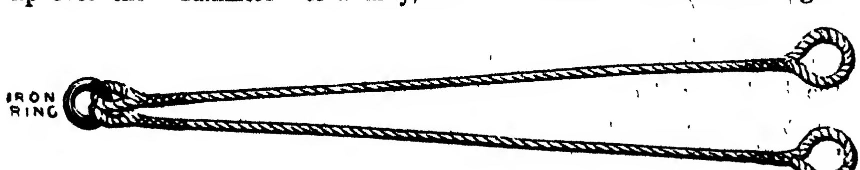
12 feet deep. This gives to each side a batter of 9 inches. One end should have a grade of 1 in 2½, the other a grade of 1 in 1½. A round post 6 inches or over in diameter, and about 8 feet in length should be sunk 4 to 5 feet in the ground, about 20 feet from the top end of the 1 in 2½ slope—post to have a cant back from the pit. The sketch hereunder will perhaps



give a better idea than the mere measurements. A pit of these dimensions will hold about 300 tons of ensilage. Such a pit can be constructed with plough and scoop, and if a 1-horse scoop is available, the batters of the sides can be kept clear without difficulty, but if the ordinary three-quarter-yard scoop is used there may be a little trouble removing the earth near the side batters. It will, probably, be necessary to dress the sides to a slight extent with a broad-faced pick, as there must be no plough marks to hold the ensilage as it settles. If the work is done by the owner with his own plant, it will, probably, cost from 4d. to 4½d. per cubic yard, but if by contract, from 8d. to 9d. per cubic yard of excavation. A pit of these dimensions represents about 715 cubic yards, so that the probable cost would run from £12 to £13 10s. in the one case, and from £24 to £27 in the other.

Preparation of drays, &c.

The ordinary drays in use on the holding should be fitted with frames similar to those used for carting hay, except—and this is an important exception—that the frame must not go across the back of the dray, but only in front and along the sides. The reason for this will appear shortly. A strop should be prepared for each dray in the following manner:—Take two lengths of stout rope (say, 2 inches circumference) each 16 feet long, according to dray used; splice a loop at the end of each length of a size to easily slip over the "summers" of a dray, and at the other end of each length



splice a small loop round a stout iron ring thus. When the drays are fitted with frames, as indicated, and supplied with a strop each, the only

other implements required are a mowing-machine, horse-rake, pitchforks, and about 150 feet of 3-inch circumference rope, with a stout iron hook firmly spliced to one end.

Preparation of land, suitable growths, &c.

The land in the vicinity of the pit should be cleared of logs and stumps as far as practicable, so as to allow the mowing-machine to be run over the ground without danger of breakage by fouling therewith. This clearing is not absolutely necessary, if the driver is careful and the owner is willing to take the risk of breakage. However, whether the land is or is not cleared of timber, the questions arise, **From what and when should ensilage be made?** The answers are, **From the natural growths,** viz., trefoil, crowfoot, wild carrot, and, generally speaking, any kind of herbage, together with variegated thistles, vines, bindies, and anything growing at the time, the mowing-machine or machines, as the case may be, being run through the whole growth indiscriminately, the thicker and more luxuriant the growth the better. **When,** is not so easily answered, as judgment is required in selecting the right time to cut, the best ensilage being made from—what may for convenience be styled—the more mature growths; at the same time they must not be allowed to become too mature. The stage of growth which should be aimed at being the last one at which the full sap is in the plant, *i.e.*, immediately before the plants begin to ripen off; but it would be better to cut before this stage is reached rather than after, the object being to secure the greatest maturity of plant life consistent with the greatest quantity of sap. The quality of the ensilage will depend on the kind of growth put in the pit—variegated thistle being probably first, with trefoil a close second. It may be as well to mention that ensilage made from growths that are too young and sappy has not as high a feeding value as that made from plant life in a more advanced stage.

Cutting crop and filling pit.

Everything being in readiness and the growth of herbage or thistles, &c., being at the right stage for cutting, the mowing-machine is started and followed by the rake, which puts the crop into windrows, &c., ready for filling the drays, which follow with the strops in position, *i.e.*, the loops put round the "summers" at the tail of the dray and the ropes laid along the bottom of the dray, with the ring over the front frame. The loading is forked into the drays, and being very heavy, it is not necessary for a man to be in the dray for loading purposes, as is the case when hay is being loaded. When loaded, the drays are taken to the pit and pulled up between the post and the pit-edge. The ring end of the strop is thrown over the load, and the hook spliced on the rope (150 feet), run through the iron ring of the strop, a turn or two of the rope is then taken round the post, and the rope paid out as the dray goes into the pit, so as take the weight of the loading off the horses; when the dray reaches the bottom the rope is held fast, with the result that, as the dray goes on, the strop pulls the loading off. The empty dray goes straight on through the pit and is drawn out at the other

end, the strop thrown in, and away it goes for another load. The next dray-load is treated in the same way, and so on, the horse walking, and drawing the dray over the previously discharged loads. As the filling proceeds it may be found necessary to have an extra horse at the pit to assist in pulling the drays over the previously discharged loads. In this method of filling the pit the only handling is the forking into the drays, and a certain amount of forking in the pit after the loads are discharged to keep them evenly spread. This latter varies with the class of filling; trefoil, herbage, and similar fine growths require but little spreading in the pit, while as the growths are coarser, the labour of spreading becomes greater; but even in the case of the coarsest growths, *e.g.* thistles, the labour is nothing like that required in, say, "tub" silos, as the trampling of the drays and horses while the filling proceeds is found a very effective aid to even spreading, and reduces the forking to a minimum—one man at the pit is sufficient for unloading and spreading. The filling of the pit is continued until the loading is 3 feet above the surface at the edges of the pit, and about 5 feet above the surface along the centre line of the pit. The filling of the pit need not be stopped on account of rain, as in the case of stacking hay, but can go on no matter how wet the crop is, provided the loads can be drawn.

Making the ensilage.

The filling of the pit must not only be done evenly, but the temperature of the contents must be carefully watched—almost as soon as the green stuff is put in the pit it begins heating, and in three or four days the temperature should rise to an appreciable extent—the temperature should not be allowed to go over 150 degrees, nor should it be kept below 80 degrees F. The best results from the herbage country in this district are obtained from a temperature of from 120 to 130 degrees F. Any bushman can rig a contrivance for protecting a self-registering thermometer, which can be used for ascertaining the temperature of the contents of the pit from time to time. A simple yet practical way of determining the temperature is to run a $\frac{3}{8}$th or $\frac{1}{2}$-inch pointed iron rod into the contents of the pit, leave it there for a time; if on drawing it out the rod is too hot to hold in the hands, the temperature is too high; if only fairly warm, the temperature is too low; whereas if it is just about as hot as one can bear, the temperature is about right. If the heat is too great, it can be reduced by riding the spare horses backwards and forwards over the contents of the pit, so consolidating the contents and excluding the air. If, on the other hand, the temperature is too low, the filling of the pit should be temporarily stopped—providing the filling has been proceeding for at least ten days—to enable the requisite temperature to develop.

Covering the pit.

After the pit is full it should be allowed to remain uncovered for a time to permit of necessary fermentation taking place—about a month is usually sufficient for this—during which time the temperature of the contents should be occasionally tested. If found to exceed 135 degrees F., the pit should be immediately covered with some of the soil which was taken from the pit during

its excavation. The soil should be evenly spread over the pit to a thickness of about 18 inches, and must be watched as it opens from time to time while the settlement of the contents of the pit is progressing. The cracks must be carefully filled as they show out, and more soil put on until the settling is over. The soil should be kept above the surface level of the surrounding country so as to run rain-water off. For covering purposes a scoop will be found very useful and effective.

Cost.

The cost of cutting, carting, filling, and covering the pit amounts to about two shillings (2s.) per ton of ensilage, but I am quite satisfied that with the experience of the past to guide me, it can be done for less than that sum.

Two pits advisable.

For the sake of economy it is desirable that two pits should be worked at the same time, so that if the filling of one has to be discontinued, that of the other can be proceeded with. The pits should not be close together, but so situated that each will be, as far as possible, in the centre of the ground from which it is supplied.

Comparison of Ensilage and Bush Hay.

The average cutting from herbage country should be from 3 to 4 tons to the acre "green," and practically the weight that goes into the pit comes out again, only in a consolidated state—in this respect it may be likened to undumped and dumped wool, the weight is there all the same. If, instead of being made into ensilage, the stuff cut is converted into hay, the amount thereof will only be about 1 ton to the acre. The comparison of feed value between ensilage and bush hay is a matter of controversy. The analyst says they are the same; the practical man says the feed value of ensilage is 25 per cent. more than bush hay; and my experience more than bears this out. To make this clearer, if the growth from 1 acre is made into ensilage and that from the adjoining acre (both growths being similar) is made into hay, the ensilage has, for general purposes, 25 per cent. more feeding value, while for breeding ewes and milch cows it is of far more value on account of its milk-producing qualities than dry feed such as hay or chaff. Ensilage is peculiarly suited for herbage country, as every class of herbage can be made into ensilage, even the much despised marshmallow, whereas it is only certain classes of herbage that can be made into bush hay, *e.g.*, crowfoot and carrot make excellent ensilage, but are valueless for bush hay. The same may also be said of the variegated thistle.

Value of ensilage for feed.

Ensilage is eaten eagerly by sheep and cattle; mares also with foal at foot take to it, but speaking generally, it is not suitable for horses. There is often considerable loss in ewes near lambing from constipation, and in lambs after lambing from the ewes going dry, in both cases owing to the dryness of the

natural feed; these losses can be avoided by giving the ewes a small daily ration of ensilage, the laxative effect of ensilage being greater, if anything, than that of green feed, and the milk-producing quality being equal to that of green feed.

Quantity of ensilage required by sheep, cost of feeding, &c.

While there is any dry feed about, a ration of 1 lb. a day will be quite sufficient for sheep, but as the dry feed disappears, it will be advisable to gradually increase the ration to 3 lb. a day. At these rates 1 ton of ensilage will give a daily ration of 1 lb. to 2,000 sheep, allowing a fair margin for possible, but not probable, waste, while 3 tons will give a full daily ration, the cost for ensilage being two shillings (2s.) and six shillings (6s.) a day respectively at the pit, which is surely a very small sum, and particularly so when it is remembered that in drought time if chaff or hay can be obtained at £8 a ton it is considered very reasonable, and also that dry feed is not nearly so suitable either for breeding ewes or milch cows as ensilage. In fact, once green feed has disappeared, there is nothing within the reach of the sheep farmer which approaches ensilage as a cheap and satisfactory food for sheep. It may be as well to emphasise the fact that this ensilage is made from the natural growths, viz., herbage, thistles, &c., unaided by irrigation or any artificial means.

Duration of ensilage.

Ensilage made in pits, as described, is ready for use in about six months. It is practically indestructible, and does not deteriorate by length of time, so that if not wanted for a number of years it is as good when opened up as when first ready for use. Further, there is no danger of loss from fire, flood, rabbits, mice, &c., the ensilage being a solid mass that must be cut out with a strong hay knife or a broad axe.

Some examples of the value of ensilage.

I have 125 head of cattle, 1,250 sheep, and about 600 lambs. The cattle are used for dairy purposes, and at present thirty-five cows are being milked. These have been fed on ensilage since Christmas,—the district being in a state of semi-drought—and unless this fodder had been available the dairying must have been abandoned, or feed bought at a price which would not have paid. The sheep feed ran short a few months ago, so 500 weaners had a load of ensilage a day fed to them for three weeks, and did well on it, until a shoot sprang up after the late rains. In this way I was enabled to save the paddocks in which trefoil was shooting for the ewes due to lamb in about a fortnight. Had the rain not come, the ewes would have been put on the ensilage within a fortnight; unless the ensilage had been available, the weaners must have been put on the roads; but being there, it placed me in the happy position of being able to keep them at home, and of knowing that the coming drop of lambs could be saved without going to a heavy expense for feed—an expense which some of the settlers in this district had to incur to save their lambs.

Other benefits.

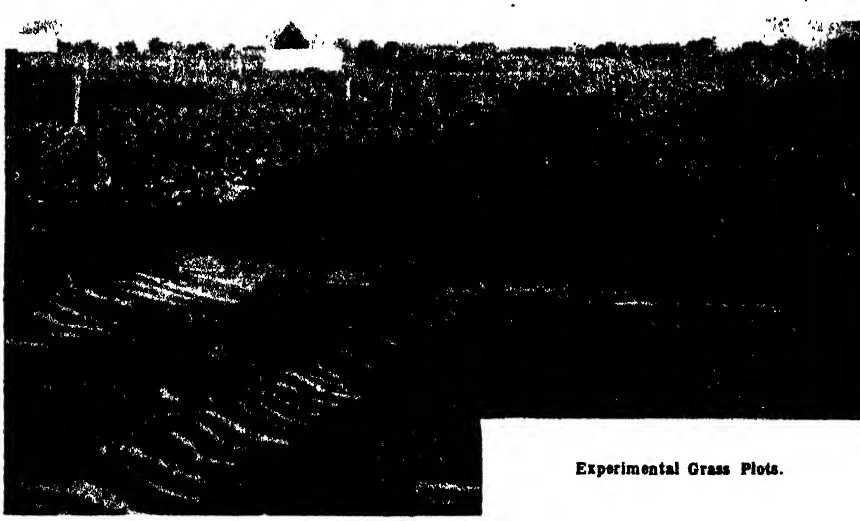
If a supply of ensilage is at hand, and is fed to the sheep as required, there will be no loss from "break in wool." Again, there is a fairly strong feeling going through this district that it is useless to improve the sheep to any great extent, as one's labours in this respect are lost owing to the sheep being wiped out by droughts. If, however, the sheep farmers would only ensilage, say, a tenth ($\frac{1}{10}$) of the feed which Nature showers upon them with such a bounteous hand in good seasons, they could resume the improvement of their flocks with the greatest confidence, and with artesian or other sufficient supply of water, should be in a position to defy a drought, or even a succession of droughts, thus lifting the pastoral industry of the west and north-west of the Central Division from its present precarious state to one of comparative safety.

LUCERNE FOR THE HILLSIDES.

"IT is rather a significant fact that those who object most strongly to lucerne, on the ground that it interferes with rotation, are, in not a few cases, men who grow two or three crops of grain in succession from the same field. Lucerne is not recommended to displace clover. Clover should be grown on all the cultivated land in short rotation, bringing it in at least once every four years. The lucerne should be considered an extra supply of fodder, and should usually be grown on the rough, hilly lands, unprofitable to cultivate. Being a nitrogen-gatherer, it rather improves the land it grows on, especially if a little ashes, and possibly bone-meal, are used on the lucerne piece from time to time. When that land is ploughed out of lucerne it will be more productive than when originally seeded down. Meantime, the manure made by the stock that consumed the hay will have gone to enrich other parts of the farm. We know no other means of building up a hilly farm that will compare with the plan of seeding the hillsides to lucerne and feeding the hay or green crop to stock. Lucerne for steep hillsides is one of the best ideas that has ever been introduced into agriculture."—*The Farmer's Advocate.*

School Agriculture

THE success attained by Mr. John Halsted, while teacher of the Public School at Eglinton, in teaching elementary agriculture, horticulture, floriculture, arboriculture, and apiculture, might be of material assistance to those likewise engaged. It is apropos at this season, because it is fast becoming a recognised fact, "that the soil is the first source of income," and affords vast opportunities to our youth. The work was an object lesson in a study which comes nearest to what will be the life study of the present-day scholar. Young people were taught to observe, and note, and trace all the common facts of vegetable and plant growth, and thus lay without effort or strain, what may be the business of their lives. Intellectual interests and sympathies were aroused. A link

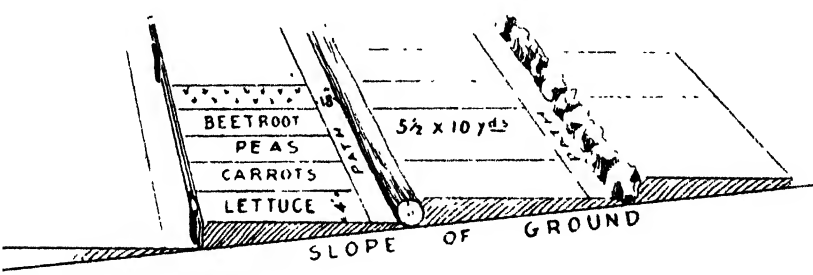


Experimental Grass Plots.

was established between the land and the people. Children must in all communities be so educated in plant life, that they learn to understand and appreciate the common things about them; to see beauty in all plant life, and to comprehend the commercial and economic value of growths. The present problem is not so much to get people on the land, as to keep them there. Considerable success was attained, but it had to grow gradually. Towards the fruition of such plans, the agricultural pursuits had to be soundly based and buttressed by scientific conclusions. The methods employed may be summed up in the following outlines:—

1. The choice of site; the laying out of the plots, embracing half an acre in extent in individual plots, in commercial, economic, grass and experimental plots, as per plan on page 908, were exercises in land measurement, levelling, &c.

2. The observation of district needs and potentialities; the theory and needs to be correlated. The lessons received practical test and confirmation from actual demonstrations in the experimental plot, the key to the whole system.
3. The cultivation of individual plots, 10 x 5½ yards, the fractional part of an acre, brought the pupils face to face with the statement of theory, and its specific application to district requirements.
4. The processes of agriculture, horticulture, floriculture, and arboriculture, soil preparation, subsoiling, cultivation, flower culture, tree planting, manuring, sowing, planting, weeding, harvesting, &c., were revealed as the gradual stages of the evolution of plant life. From the effect of water, wind, and frost, the district varieties and economic uses of plants grown in the ground, and in glass tubes with moist sand or water only, with their botanical, zoological, geological and meteorological nature, successive lessons were gathered.



5. The working of commercial and economic plots illustrated different varieties of cereals, vegetables, grasses, &c., and the effect of diverse kinds of manures as affecting same. The relation of deep and superficial cultivation arose from the individual plots.
6. Out of insect life observation there grew an elementary investigation of insect pests and their remedies, and the entomology of the district.
7. From the operations of farm work (the breaking of tools, the making of gates, the digging of post-holes, the erecting of fences) there arose a demand for inventiveness. Methods of rough carpentering were applied. Soft and hard woods and their respective capabilities had to be applied.
8. Viewed as an object lesson of utility, the making of apiarian appliances, the cost of material, and the labour, were of enormous value.
9. The care of implements—a place for everything, and everything in its place (for each tool had its rack)—taught neatness. Tools could always be used, but the pupil removing the implement was answerable for its daily return and cleanliness. No new tool to be used unless seasoned by the handle being rubbed with grease.

10. Soil classification and physical properties were shown by collections of sedentary, transported, and humous soils; sand, clay, and calcareous rocks, with lessons on their derivation and disintegration. The physical properties were exemplified by collections of rocks, dry sand, dry clay, dry loam. These were weighed, burnt, or mixed with water and allowed to stand in glass tubes.
11. Showing the scholar the relation between theory and practice, large drafts were made on his individual powers. He is shown things, he is trained to do things, he is led to follow processes and apply principles. Thus is educed, slowly and imperceptibly, but surely, Faculty; thus grows the spirit of Self-dependence; thus is evolved Individuality. And this is achieved, not only without the sense of drudgery and of tedious toil, but the sense of curiosity is awakened, and personal activities are thrown on the side of production.

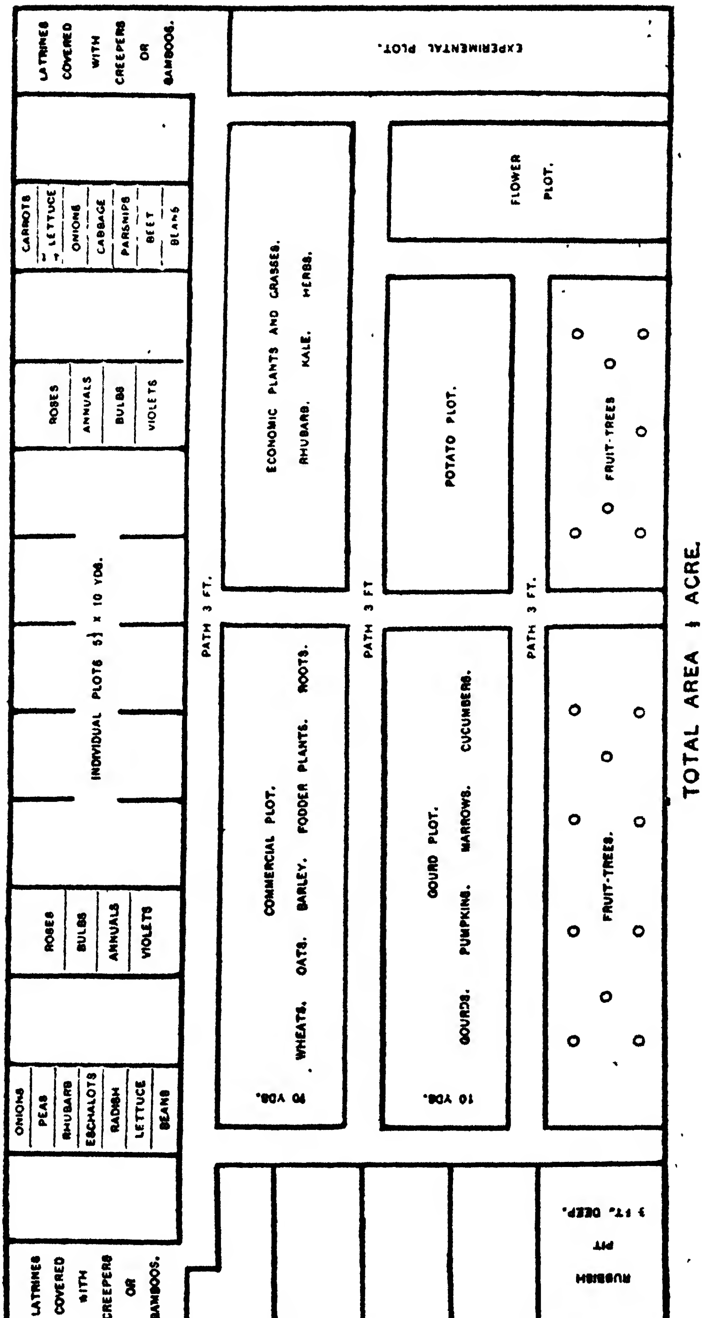
Wheat Experiment Plots.

Mottoes.

"A little well done is better than much attempted, and nothing done."
"What is attempted must be thorough, and well carried out."
"Every day in Life is a leaf in thy History."

The correlation of practice and theory is illustrated by one of the weekly lessons from the programme.

Monday.—Time, 20 minutes. Theory. A lesson in detail on some specific plant (Lettuce). How and when to sow; necessary soil; cultivation; nature and varieties of seeds to be exhibited; uses and how applied.


LATRINES COVERED WITH CREEPERS OR BAMBOOS.
EXPERIMENTAL PLOT.
CARROTS
LETTUCE
ONIONS
CABBAGE
PARSNIPS
BEET
BEANS
ROSES
ANNUALS
BULBS
VIOLETS
INDIVIDUAL PLOTS 5½ x 10 YDS.
ROSES
BULBS
ANNUALS
VIOLETS
ONIONS
PEAS
RHUBARB
ESCHALOTS
RADISH
LETTUCE
BEANS
LATRINES COVERED WITH CREEPERS OR BAMBOOS.
ECONOMIC PLANTS AND GRASSES.
RHUBARB. KALE. HERBS.
FLOWER PLOT.
POTATO PLOT.
FRUIT-TREES.
PATH 3 FT.
PATH 3 FT.
PATH 3 FT.
TOTAL AREA ½ ACRE.
COMMERCIAL PLOT.
WHEATS. OATS. BARLEY. FODDER PLANTS. ROOTS.
GOURD PLOT.
GOURDS. PUMPKINS. MARROWS. CUCUMBERS.
FRUIT-TREES.
20 YDS.
10 YDS.
RUBBISH PIT 3 FT. DEEP.

Tuesday.—Time, 20 minutes. Practice. In the experimental plot, by the teacher. A practical demonstration of sowing lettuce seed ; removal and treatment of plantlets from seed box ; transplanting about three plants.

A Practical Demonstration.

Wednesday. —Time, 20 minutes. Each pupil is given three plants, and the lesson of the previous day has to be implicitly followed by the pupils in their individual beds. Supervision by the teachers.

Pupils at Work.

Thursday.—Weeding, and any work the season might call for.

Friday.—Inspection day. Beds to be neat, weeds removed, paths cleaned. Retrospection.

The Educational scheme is interesting. The syllabus, embracing a two years' course, was as follows, subjects to be arranged to suit the seasons:—

First Year.

1. Agriculture, Horticulture, Floriculture, and Arboriculture in relation to individuals and the nation.
2. Rocks and soils: varieties, disintegration, and properties.
3. Drainage, surface and deep: storage of water, irrigation.
4. Implements used in cultivation: uses, care, repairing, mending harness.
5. Cultivation: methods, digging, trenching, ploughing, harrowing, rolling.
6. Plants: composition, absorption, transpiration, assimilation, respiration, growth and reproduction.
7. Manures: origin, varieties, natures, application.
8. Seeds: germination, sowing, transplanting, harvesting.
9. Pests affecting plants: treatment, remedies.

Pond to receive Surface Drainage.

Second Year.

1. Revision of important points in previous year's work.
2. Orcharding: selection, planting, effect of soil and climate, treatment.
3. Pruning, grafting, budding, treatment of roots.
4. Cultivation of economic plants, small fruits, legumes, gourds, cucumbers, rhubarb, asparagus, celery, mushrooms.
5. Cultivation and propagation of flowers and ferns.
6. Pests and diseases affecting fruit: varieties, production, preventives and remedies.
7. Insects: life history, relation to plants, friends, foes.
8. Apiculture.

Bathurst Experimental Farm.

R. W. PEACOCK.

Treatment of Seed Wheat—Formalin.

At the Bathurst Experimental Farm all the wheat sown in 1905 was treated with a solution of formalin of the strength of 1 lb. of formalin to 400 lb. of water (40 gallons), the grain being immersed for five minutes. The results were extremely satisfactory, there being practically no bunt in the crops. Previous to 1905 experiments had been carried out to test the relative merits of bluestone and formalin. It was found that bluestone, in dry seasons, interfered with the germination of the grain. For this reason formalin was substituted for bluestone last season.

An experiment to test whether the formalin solution retained its properties when exposed to the air in the open dipping vessel was carried out.

Particulars are as follows:—

Variety.	Row.	Treatment.	Date sown.	No. of grains sown.	No. of bunty plants.	No. of clean plants.	Total plants grew.	Percentage bunty.	Percentage clean.	Date harvested.
			1905.							
Steinwedel.	1	Infected and not treated	15 May	60	51	5	56	91·07	8·92	2 January, 1906.
	2	do do	do	60	44	7	51	86·27	13 72	
	3	Infected and soaked 5 minutes in a 1 to 400 solution formalin, one day after preparing the solution.	16 May	60	2	40	42	4 76	95·23	
	4	Infected and soaked 5 minutes in a 1 to 400 solution formalin, two days after making solution.	17 May	60	0	47	47	0 00	100·00	
	5	Infected and soaked 5 minutes in a 1 to 400 solution formalin, after standing for four days.	19 May	60	0	41	41	0 00	100·00	
	6	Infected and soaked 5 minutes in a 1 to 400 solution formalin, after standing for five days.	20 May	60	0	56	56	0 00	100 00	
	7	Infected and soaked 5 minutes in a 1 to 400 solution formalin, left standing for eleven days.	26 May	60	2	56	58	3·44	96 55	
	8	Infected and soaked 5 minutes in a 1 to 400 solution formalin, after standing for eighteen days.	2 June	60	1	52	53	1·88	98·11	
	9	Infected and soaked 5 minutes in a 1 to 400 solution formalin, left standing for twenty-eight days.	12 June	60	15	42	57	26·31	73·68	

It will be gathered from the above that the solution lost its value upon being exposed. It is in all probability unsafe to use solutions of the above strength after allowing them to be exposed for one week. It is much safer to use only fresh solutions, and such are to be recommended.

Plump versus Pinched Grain.

An experiment was carried out with wheat at this farm to test the relative values of plump and shrivelled wheat grain. Rows containing 100 grains were planted. The sample was carefully graded with sieves ranging in mesh from 3·25 millimetres to 2 millimetres. The grains retained by the first were the very large ones and the residue represents those which the smallest mesh could not retain, they being very small. Only perfect grains were sown. The germination throughout was low, the conditions not being favourable for high percentages.

The results are given below, and the yields decidedly favour the plump grains.

In order to realise the differences in yields better, we will suppose that the highest yield in Row 1 of series A yielded 17 bushels per acre. Row No. 5 being the lowest would give at the rate of only 13¼ bushels per acre. In series B, row 9 would give at the rate of 16½ bushels per acre, whilst row 12 would but give 11 bushels to the acre.

Variety.	Row.	Size of Grain	Series.	Date Sown.	Percentage grew.	Date harvested.	Weight of dry sheaf	Weight of grain.
				1905.		1905.	lb.	lb. oz.
Steinwedel wheat.	1	Grain retained by 3·25 mm. sieve	A	22 May	76	22 Dec.	8	2 2
	2	Grain retained by 3·00 mm. sieve	,,	,,	68	,,	7¾	1 15½
	3	Grain retained by 2·75 mm. sieve	,,	,,	78	,,	9½	2 1
	4	Grain retained by 2·50 mm. sieve	,,	,,	77	,,	8¼	2 1
	5	Grain retained by 2·25 mm. sieve	,,	,,	69	,,	7¼	1 10½
	6	Grain retained by 2·00 mm. sieve	,,	,,	63	,,	7¾	1 14
	7	Residue—very small grains	,,	,,	72	,,	7¼	1 12
	8	Grain retained by 3·00 mm. sieve	B	,,	75	30 Dec	7¾	1 13¼
	9	Grain retained by 2·75 mm. sieve	,,	,,	74	,,	7½	2 1
	10	Grain retained by 2·50 mm. sieve	,,	,,	68	,,	6¾	1 14
	11	Grain retained by 2·25 mm. sieve	,,	,,	79	,,	6¼	1 11¼
	12	Grain retained by 2·00 mm. sieve	,,	,,	70	,,	5¾	1 6
	13	Residue—very small grains	,,	,,	65	An outside row and rejected for yield on that account.		

NOTE.—The seed wheat was grown the previous season, and was sown in the above experiment in drills 2 links apart, a grain being planted at every link in the row and 1 inch deep. It was noted on 12th June that all the rows seemed to have made an equally vigorous start.

The Basis of Payment for Cream.

P. DENSTON,
Laboratory Assistant to Dairy Expert.

The New South Wales Government Cream Chart.

SINCE the publication of the Cream Chart in the *Agricultural Gazette* for December, 1904, a considerable amount of interest has been taken by farmers in the methods adopted by factories as a basis of payment for their cream supplies. Hardly a day passes by without samples of cream being sent by them to the Dairy Laboratory to be tested. The letters accompanying these samples go to show that a number of farmers, at least, have still great doubts as to whether they are paid for all the butter produced from their cream. These letters also show that there are still some factories who claim that they are unable to pay on the basis laid down in the abovementioned Cream Chart, while, again, some critics endeavour to point out that the chart does not make sufficient allowance for the difference between weighed and measured samples. Such figures as are given by these latter critics make it obvious that there are still some people testing who do not know how to take a proper sample of cream. The best proof in these cases is practical results, and the following table of figures will be of interest to factory managers and others, as giving some idea of the difference between weighed and measured tests of cream samples, before and after applying corrections for the specific gravity.

Most of the testing of cream by the Babcock method that is performed in this State is done on measured samples: 8·75 c.c. of cream being taken for the test, and the results obtained are multiplied by two, in order to obtain the percentage of fat that is present. This method of testing is convenient, but deceptive, owing to the fact that an 8·75 c.c. pipette will never deliver 9 grammes of cream into the test bottle, but always a less amount.

The reason for this is that the specific gravity of cream is always lower than that of milk, owing to its greater fat content. It may vary from ·970 in a cream containing about 60 per cent. of fat to 1·01 in a cream containing 20 per cent. of fat. The specific gravity of a cream containing 30 per cent. of fat is about the same as water, or 1·000, and an 8·75 c.c. pipette will, therefore, only deliver 8·75 grammes of such a cream. This is, of course, provided that the cream does not contain any air or gas bubbles, the inclusion of which would further decrease the weight delivered.

Various endeavours have been made to avoid the necessity of weighing samples of cream for factory testing. It was at first attempted to adjust figures by the use of pipettes of larger capacity than 8·75 c.c. Such

methods were based on a happy ignorance of the subject, and either fell naturally into disuse, or were repressed by law. Tables of corrections to be applied to the fat-readings were then devised, and when correctly constructed have proved very satisfactory, provided that the cream samples be smooth and in generally good condition.

Babcock Test. 9-gramme sample. Weighed.	Babcock Test. 8·75 c.c. sample. Measured.	Chart result for 8·75 c.c.	Difference too high.	Difference too low.	Babcock Test. 9-gramme sample. Weighed	Babcock Test. 8·75 c.c. sample. Measured.	Chart result for 8·75 c.c.	Difference too high.	Difference too low.
20·0	20·0	19·6	·4	...	40·0	38·5	38·5	..	..
23·2	23·0	22·5	·5	..	40·5	39·0	39·0	...	...
24·0	23·5	23·5	..	..	40·5	39·0	39·0	.	...
25·0	24·5	24·5	...	...	41·0	39·0	39·5	...	·5
25·0	24·5	24·5	...	...	41·4	39·5	39·8	..	·3
25·5	25·0	25·0	..	...	41·6	39·5	40·0	..	·5
26·5	26·0	25·8	·2	...	42·0	40·5	40·3	·2	..
27·0	26·5	26·3	·2	..	42·2	40·5	40·5		
29·0	28·5	28·2	·3	...	42·4	40 5	40·7	.	·2
30·0	29·5	29·1	·4	.	42·5	41·0	40·8	·2	
30·5	30·0	29·6	·4	...	42·8	41·0	41·0	..	.
30·8	30·0	29·9	·1	...	42·8	40·5	41·0	.	·5
31·0	30·0	30·1	...	·1	45·0	43·0	43·1	.	·1
31·0	30·0	30·1	..	·1	45·0	43·0	43·1	.	·1
31·0	30 0	30·1	...	·1	45·5	43·5	43 6	.	·1
32·0	31·0	31·0	...	...	45 8	44·0	43·9	·1	
32·0	31·0	31·0	..	...	46·0	43·5	44·0	.	·5
33·0	32·0	32·0	...	...	46·0	43·5	44 0	..	·5
33·0	32·0	32·0	..	...	46·4	44·5	44·5	...	.
33·0	32·0	32·0	...	...	47·0	45·0	45 0	...	..
33·5	32·5	32·5	..	..	47·0	45·0	45·0	...	
33·6	32·4	32·6	..	·2	47·0	45·0	45·0		.
34·0	33·0	33·0	...	...	47·0	45·0	45·0	.	..
34·0	33·0	33·0	...	...	47·5	45·0	45·5	...	·5
35·0	34·0	33·9	·1	..	47·5	45·5	45·5		...
35·0	34·0	33·9	·1	...	47·6	45·0	45·5	.	·5
35·0	34·0	33·9	·1	...	48·0	46·0	45·8	·2	.
35·5	34·0	34·3	..	·3	48·0	46·5	45·8	·7	
36·0	34·5	34·8		·3	48·5	46·5	46·3	·2	...
36·0	34·5	34·8	...	·3	48·8	47·0	46 6	·4	
36·0	34·5	34·8	..	·3	49·0	46·5	46·8	..	·2
36·4	35·5	35·2	·3	...	49·0	47·0	46·8	·2	...
36·5	35·0	35·2	...	·2	49 5	47·0	47·2	...	·2
37·0	35·5	35·7	.	·2	50·0	48·0	47·7	·3	..
37·0	36·0	35·7	·3	...	51·0	48·5	48·6	...	·1
37·5	36·0	36·2	...	·2	51·2	49·0	48·8	·2	..
37·5	36·0	36·2	...	·2	51·2	49·0	48·8	·2	..
38·0	36·5	36·7	...	·2	51·5	49·0	49·0	...	...
38·0	36·5	36·7	..	·2	51·5	49·0	49·0	...	...
38·0	37·5	36·7	·8	.	53·0	50·0	50·5	..	·5
38·8	37·5	37·4	·1	...	53·0	50·0	50·5	...	·5
39·0	37·0	37·6	..	·6	53·2	50·5	50·6	...	·1
39·0	37·0	37·6	...	·6	54·0	51·5	51·3	·2	...
39·0	37·0	37·6	..	·6	54·0	51·5	51·3	·2	...
39·2	37·5	37·8	...	·3	54·0	51·5	51·3	·2	...
39·2	37·5	37·8	...	·3	55·0	52·0	52·2	...	·2
39·2	37·7	37·8	...	·1	55·2	52·0	52·4	..	·2
39·4	38·0	38·0	..	...	55·6	53·0	52·7	·3	...
39·5	37·0	38·0	...	1·0	58·0	55·0	54·9	·1	...
39·8	38·0	38·3	...	·3	59·0	55·5	55·8	...	·3

—Table, "Testing Milk and Cream," M. A. O'Callaghan, 1905.

The table shows the tests by weight and measure of the last hundred samples of cream sent to the laboratory by farmers who wished to check their factory returns, and by factory managers who desired to prove to farmers that their testing was correct. A few of these creams may be described as having been in good condition for sampling, but the majority were the reverse. Being sent from all parts of the State, and often having been several days in transit through the post, they were generally fairly stale when received at the laboratory. A few had been so knocked about that they were quite unfit for testing, until after the addition of chemicals; the results of these are not given in the table, as measured tests were not made. The method of sampling was the same in all cases. The cream was warmed and stirred until fluid, and occasionally poured from one vessel to another until cool, before being measured. Weighed samples were taken at the same time.

The first column gives the results obtained from 9 gramme samples, and the second shows the tests from measured samples of the same creams. The third column shows what the tests would be, if calculated from Mr. O'Callaghan's chart. This is what the measured test should have shown as calculated by specific gravity corrections from the weighed results, and the differences are due to the usual factors which cause errors when samples are measured, such as gas or air bubbles, taking the sample at too high a temperature, &c

An examination of the preceding table shows that of 100 samples of cream, when compared with figures obtained from the O'Callaghan Chart:—

26 differed	Nil.	10 differed	·5 per cent.
16 ,,	·1 per cent.	3 ,,	·6 ,,
24 ,,	·2 ,,	1 ,,	·7 ,,
14 ,,	·3 ,,	1 ,,	·8 ,,
4 ,,	·4 ,,	1 ,,	1·0 ,,

The Babcock method of testing cream is only accurate to about ·5 per cent., when the tests are made in the ordinary 30 per cent. bottles that are generally used for the purpose. Such bottles were used for these tests. They are graduated to show ·5 per cent., and cannot be accurately read much closer than ·25 per cent. This, when doubled, gives an experimental error of ·5 per cent. of fat. By regrouping the above figures, it is found that—

84 differed less than ·5 per cent 10 differed ·5 per cent.
6 differed more than ·5 per cent.

It was to be expected that the error would be greater in the case of high-testing creams, owing to the sampling of such samples being more difficult. This was not found to be the case.

For 10 creams	testing from	20 p. cent.	to 30 p. cent.,	the average	difference was	·20 p. cent.
,, 41	,,	30 ,,	40 ,,	,,	,,	·21 ,,
,, 33	,,	40 ,,	50 ,,	,,	,,	·21 ,,
,, 16	,,	50 ,,	59 ,,	,,	,,	·20 ,,

The average difference for the 100 samples was ·215 per cent., which amounts to an immaterial quantity of butter per 100 lb. of cream.

The preceding figures go to show that if a corrected chart is used for calculating butter returns, the testing of cream by measure is not so inaccurate as some people believe. Whether the cream samples be measured or weighed, there are many causes of inaccuracy in the process of testing, as usually done, that factory managers should consider when they find a difficulty in obtaining an over-run of 17½ per cent., this being the figure on which the commercial butter returns are calculated in the Cream Chart. The chief causes of error in the Babcock method, as usually done, are due to faulty sampling, the use of acid of incorrect strength, and sometimes to the addition of amylic alcohol. Any of these causes may produce too high a test, and a consequent reduction in the over-run.

Also, it may be mentioned that a great number of people are in the habit of reading Babcock tests too high. If the fat column is at the proper temperature (120 degrees F.), and the reading be made to the top of the meniscus, or curvature of the upper part of the fat in the neck of the bottle, the results obtained will undoubtedly be too high. Webster and Gray* have shown that to obtain the nearest results to the quantity of fat present, it is necessary to deduct four-fifths of the meniscus from the highest reading obtainable, and, after doubling the reading, to increase the results by ·2 per cent. This calculation is rather complicated for practical work; but with regard to the 30 per cent. type of bottles that are commonly used, and in which the meniscus generally amounts to ·5 per cent., the doubled figure obtained by reading to the top of the meniscus may be reduced by ·5 per cent., with but slight error in the results. Close results to truth can be obtained more simply by reading the test to half-way up the meniscus.

In conclusion, it may be said that it is not the purpose of the writer to suggest that cream samples should be measured for testing, in preference to their being weighed. It would be more satisfactory if they were all weighed; but for many reasons, which it is unnecessary to discuss in the present article, the general adoption of this method by our factories is not likely to take place for some considerable time.

Meanwhile, it is shown that in careful hands the error in Babcock testing by measure is small, provided that the difference between measure and weight be known and allowed for; or in other words, when a properly based chart is used.

* Webster and Gray. "The Fat-Testing of Cream by the Babcock method." Bureau of Animal Industry, U.S.A. Bulletin No. 58.

Wheat "Smut" and its Prevention.

An Object-lesson for Rural Schools.*

GEO. L. SUTTON,
Cowra Experimental Farm.

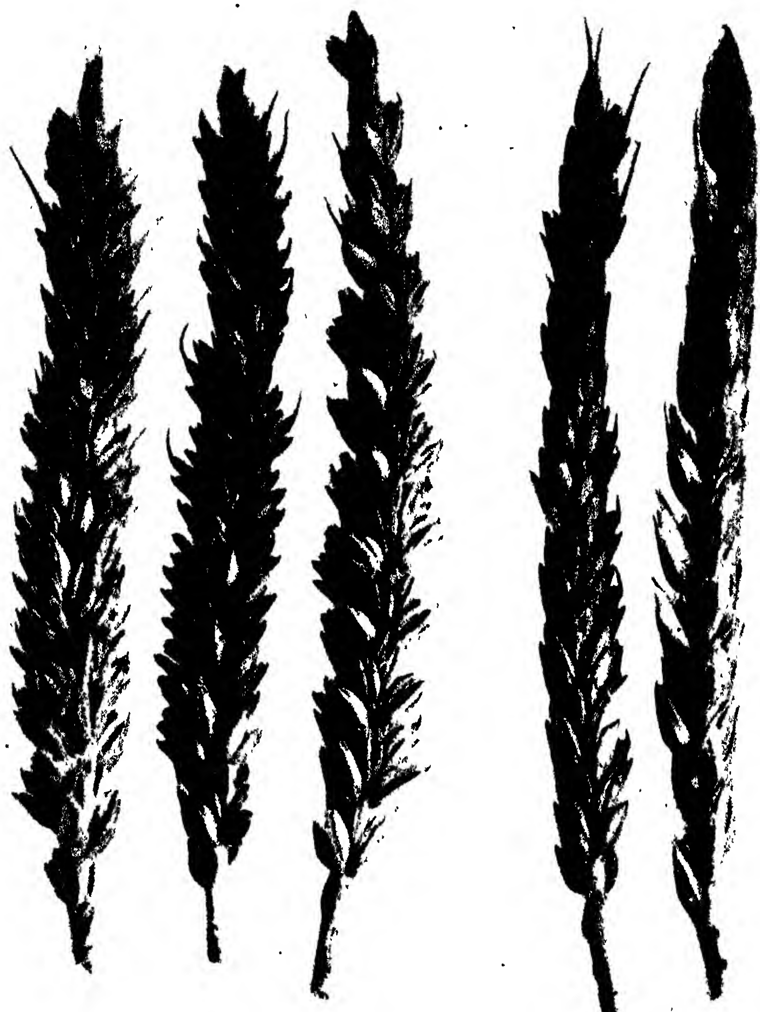
The wheat-grower is troubled with two pests known as Smut. They are Bunt or Stinking Smut, and Loose or Flying Smut. When, however, the farmer talks about "smut," he is almost without exception referring to Bunt or Stinking Smut, so called from the objectionable smell it has, and which is quite noticeable even if only a little be present in a large quantity of grain.

There are considerable differences between the two smuts, but from the wheat-grower's standpoint, the chief one is that "smut" (Bunt) can be readily prevented by treating the seed-wheat before it is sown, whilst "loose smut" requires special treatment of the seed for its prevention in the resulting crop. Other differences are that "smut," *i.e.*, Bunt (*Tilletia tritici*), is characterised by what, in healthy plants, would be the grains being filled with a black, dusty mass of foul-smelling powder, which remains unseen until these masses, called *bunt-balls*, are disturbed or broken, usually by the operations of harvesting or thrashing. Loose or Flying Smut (*Ustilago tritici*) is found as a loose, dark, dusty mass, which ripens as the wheat plant is flowering, and before harvest has usually been *entirely* blown away, leaving the naked stalk without any grains attached. On account of this characteristic, it is possible for its presence in a crop to be overlooked, even though it has been there in fairly large quantities, for the absence of ears on the clean naked stalks may be attributed to some agency other than the real one, "loose smut." As the smut is loose and flies away (blown by the wind), it is easily seen how it obtains the name of Loose or Flying Smut. "Loose smut" has no objectionable odour.

As "loose smut" requires special treatment of the seed-grain for its prevention, the most practical way of getting rid of it, after it has made its appearance on a farm, is to use for seed only grain which is known, as the result of an examination of the growing crop at the proper time,

* The most suitable time for this lesson will be during the month preceding the commencement of the planting season. The matter will then be of greatest interest, and the lesson will be likely to prove of the greatest value. To make the lesson attractive, practical demonstrations of the different preventive treatments might be given, and specimens of bunt-balls and ears affected with "Smut" (bunt) and "loose smut" exhibited. The specimens will require to be collected about October and November. For those who are unable to collect specimens, a limited number of bunted ears and bunt-balls will be available on application to the Manager, Cowra Experimental Farm.

to be entirely free from this disease. *To determine whether "loose smut" is present in a crop the examination should be made when the plants are flowering.*



"Smutted" Ears. "Clean" Ears.

The yearly loss from these two pests, and especially from "smut," is very great; it is far greater than the average farmer is aware of or is willing to admit takes place. In addition to the actual reduction in the grain yield due to bunt-balls taking the place of what otherwise would be sound grains, there is a large indirect loss due to the lessened commercial value of the sound grains on account of the spores of smut which

adhere to them, their presence being prominently noticeable by the objectionable smell which is characteristic of this disease. Some crops are so badly smutted, *i.e.*, have such a large percentage of ears containing bunt-balls, that the sound grain is valueless for milling purposes.

This loss is the more regrettable because it is recognised that, by proper and thorough treatment of the seed-grain, "SMUT" CAN BE ENTIRELY PREVENTED. If, however, no preventive measures are taken, the amount of damage done and consequent loss will increase from year to year.

"Smut" belongs to a low form of plant life, each member of which is called a *fungus*. It is just as much a plant as wheat is a plant, and it is as distinct from other smuts as one variety of wheat is from another. As the wheat plant is produced from a seed, and in its turn produces seeds to perpetuate itself, so is the "smut" plant produced from a seed, and in its turn matures and produces seeds. These seeds are exceedingly small—microscopic—and are known as *spores*. These spores are found, when matured, in masses occupying the place of the wheat kernels, and in their unbroken state these masses are called *bunt-balls*.

There is, however, one very essential difference between the wheat plant and the "smut" plant. The wheat plant obtains the food necessary for its growth directly from the soil; the "smut" plant is unable to do this, but by forcing an entrance into the tissues of the wheat plant obtains the nourishment necessary for its growth from the substance of that plant. Because "smut" thus preys upon the wheat plant, instead of obtaining its food directly from the soil, it is called a *parasite*, and the plant (wheat) upon which it lives is called its *host*.

The conditions which are suitable for the germination of the wheat seed are suitable also for the germination of "smut" spores. If, therefore, seed-wheat is planted with healthy "smut" spores adhering to it, and the conditions are favourable for the germination of the wheat, the "smut" and wheat germinate at the same time—the "smut" plant obtains an entrance into the young wheat plant, grows with it, and finally matures its bunt-balls at the time the wheat plant is flowering. For many years it was believed that only in this way, and during a short period immediately following the germination of the wheat plant, was it possible for *infection*, *i.e.*, the introduction of "smut," to take place. Quite recently, however, a German botanist named Hecke has, by careful experiment, proved that infection can take place and that "smut" can be established during the flowering stage of the host plant.*

Whilst "smut" spores will germinate under conditions which cause wheat seeds to germinate, it is believed that the "smut" spores require considerably less moisture for their germination than wheat seeds require, and that in consequence they will and do germinate under conditions far too dry for the germination of wheat seeds. This will explain why self-sown wheat crops are invariably free from "smut," even though the seed which produced them was badly smutted, for, the seeds of self-sown

* "The Journal of the Board of Agriculture," February, 1906.

crops are usually dropped on the ground during periods when the conditions are too dry for their germination, and if seeds, even with a very large quantity of "smut" attached, are sown in ground too dry for them to germinate, yet moist enough for the spores to germinate, it follows that as the "smut" plants, after germination, are unable to obtain their food directly from the soil, and as there are no wheat plants to procure that food for them, they must perish from lack of nourishment,—in other words, they must die of starvation. The wheat seeds germinating later produce plants which, having no "smut" plants at hand to attack them, mature a "clean" crop, *i.e.*, one free from "*smut.*"

Bunt Balls. The "pickle" has no effect upon the spores contained in the unbroken ones.

The chief (almost the only) cause of "smut" is the sowing of seed which has healthy spores adhering to it. It follows, therefore, that if the vitality of these spores can be destroyed, or if the plants resulting from the germination of the spores are destroyed, that the grain crop will be "clean." Methods have been introduced for successfully destroying the vitality of the spores, but no method has yet been devised for killing the "smut" plants after they have germinated. Occasionally, as in the case of self-sown crops, the natural conditions prevailing at the time the seed is planted are the cause of a "clean" crop being produced from untreated smutted seed; but to depend upon this chance method of obtaining clean

crops is very unwise and likely to lead to disappointment. It is far wiser and more businesslike to destroy the vitality of the spores, and thus prevent them growing. To do this, we require something which will not impair the germinating power of the grain, but which will effectually destroy the vitality of the "smut" spores. Several substances have been found which more or less fulfil these conditions. The best known in this State are hot water and solutions of bluestone and formalin. As their function is to destroy or kill a fungus, they are called *fungicides.* Amongst farmers they are known as "*pickles*" or "*steeps.*"

Any of these fungicides will effectually destroy the spores, but each, in a greater or less degree, affects the germinating power of the seed treated.

Whilst all the methods recommended for treating seed-grain will destroy the spores which have become free from the bunt-balls, NONE OF THEM ARE EFFECTIVE FOR DESTROYING THE SPORES WHICH ARE CONTAINED IN UNBROKEN BUNT-BALLS. IT IS THEREFORE NECESSARY, IF ANY TREATMENT IS TO BE EFFECTUAL, THAT THE UNBROKEN BUNT-BALLS BE EITHER REMOVED OR BROKEN BEFORE THE SEED IS "PICKLED." If this is not done, the bunt-balls, during the subsequent operation of planting, are likely to become broken, and their healthy, vigorous contents dispersed over the treated grain, thus nullifying the effect of the treatment; for the effect of the treatment is to destroy the spores adhering to the grain, it does not render the grain immune to the attacks of "smut."

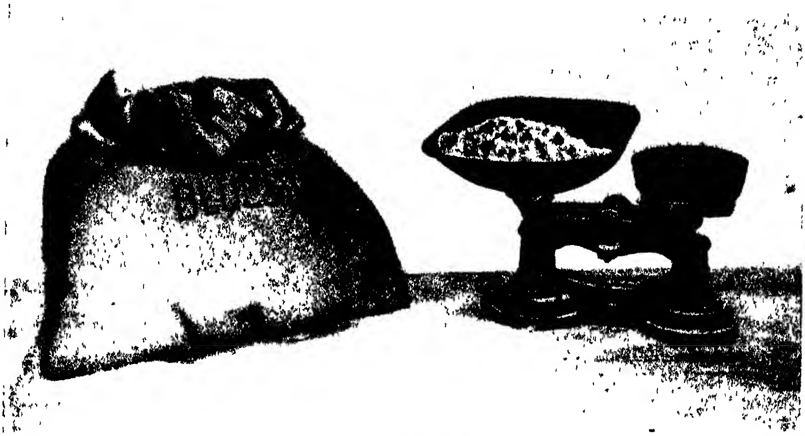
It has been calculated that in a single bunt-ball, no larger than a grain of wheat, there are about 4,000,000 spores, each of which is capable of causing one wheat-plant to be smutted. In a bushel of wheat there are 600,000 to 1,000,000 grains. There are, therefore, in a single bunt-ball enough spores, if regularly and evenly distributed, to provide each grain in a bushel of wheat with from four to six spores. The great necessity for removing or breaking the bunt-balls, so that the fungicide can act upon their contents, is obvious.

It is easier to remove the bunt-balls than to ensure that all are broken, and, fortunately, this can be done without any great difficulty. Bunt-balls are lighter than wheat and float in water, so that if the wheat to be treated is poured slowly into the "pickle," and in such a way that the bunt-balls will not be carried down by the grain, they will float on the top, and can be skimmed off and destroyed. As a further precaution, and in order to release any bunt-balls which may have been carried down by the grain, the grain should be stirred or raked; this is also likely to break up any partially-broken bunt-balls which have sunk and become soft.

Until bunt-resisting varieties are produced, and are in general cultivation, it is advisable to assume that all seed is more or less smutty, and requires to be "pickled," for, seeing that the spores are so minute, it is quite possible for enough to cause considerable damage in the desultory crop to be present on the seed grain, and yet for their presence to escape notice.

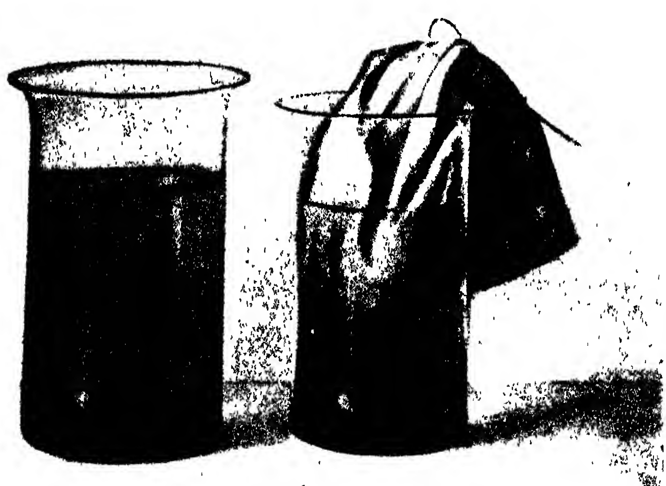
The Bluestone Treatment.

The most popular fungicide for treating seed-grain, and the one in most general use in this State, is *Bluestone* (copper sulphate). The



Bluestone is easily weighed.

efficacy of this fungicide depends upon bringing the "smut" spores in contact with a solution of bluestone for a sufficient length of time to



The wrong and the right way to dissolve Bluestone. The right way is to suspend the crystals in an open bag just below the surface.

destroy their vitality. Various plans are adopted for attaining this object. Whatever method is adopted, it should be done with sufficient

thoroughness to ensure that no spores escape coming into contact with the fungicide long enough to destroy their vitality. A weak solution requires a relatively longer time to destroy the spores than a strong one does. At one time it was the common practice to "steep" the seed in a weak solution (½ per cent.) for twelve hours, but this method has now been almost superseded by methods which require the seed to be "steeped" for a few minutes—three to five—in a stronger solution of, say, 2 per cent. The details of some methods for treating seed-grain with bluestone are as follows:—

1. Make a solution by dissolving 1 lb. of bluestone in 5 gallons (50 lb.) of water, thus making a 2 per cent. solution. Soak the seed for five minutes; allow the seed to drain, and then immerse the wet grain in lime-water for two or three minutes. When dry enough the grain can be planted.

   Instead of immersing the grain in lime-water after its treatment with bluestone, it may be sprinkled with air-slacked lime or wood ashes, which will help to dry it.

2. Make a solution by dissolving 1 lb. of bluestone in 1 gallon of water (that is, a 10 per cent. solution), and sprinkle this over the contents of a bag of wheat which has been previously emptied on to a wooden floor. During the operation of sprinkling, the wheat should be turned over several times to ensure the grains being evenly and regularly wetted.

3. Make a solution by dissolving ½ lb. of bluestone in 10 gallons (100 lb.) of water. Soak the seed for twelve hours, then dry and sow.

The first method is gradually becoming general. It is rare to find a farmer adopting the third method, and those who use the second method are becoming comparatively fewer each year. The actual details of the application of this method vary on different farms, and depend to some extent upon the conveniences available and the ingenuity of the operator. The plan illustrated is a very common one. The wheat, about 2 bushels at a time, is placed in loosely-tied "*butts*"—a partially-filled bag is known as a "butt"—and then, by means of a lever, is lowered into the solution, and after remaining in it the necessary time it is raised on to a sloping bench or trough, where the superfluous liquid can drain back into the cask. When the draining is complete, the "butt" is again lowered, by means of the same lever, into the lime-water contained in an adjacent cask, and after remaining for two or three minutes is raised out again and allowed to drain, but in such a position that the superfluous moisture does not run back into either of the casks.

Another method adopted on some farms is to place the seed-wheat, either loose or in bags, in elevated casks or troughs, and pour the bluestone solution over it. After it has remained on the wheat the necessary time it is run off into another cask or trough placed in a lower position. The troughs used are often made of hollow logs.

After the seed has been treated, it requires some drying before it can be planted with a drill. If the seed is to be planted within a reasonable time—say, within a week—all that is necessary is to place the "butts" where they can drain freely, when the seed will be ready to sow any time after a few hours. If the planting is not to take place for some considerable time, it is advisable to dry the seed thoroughly. This can be done very expeditiously by spreading it out in a thin layer on a sheet or on a floor.

Many farmers go to a considerable amount of *unnecessary* trouble to obtain boiling water in order to dissolve the bluestone used in making up the solutions. Bluestone will readily dissolve in cold water, if

Formalin being a liquid is easily and is generally measured. The measuring should be accurately performed.

treated in the proper way, which is as follows:—The necessary bluestone, after being weighed, should be suspended in an open bag *just below the surface* of the required quantity of water. In a few hours, even in the very coldest weather, the crystals will dissolve without any further attention. If, however, the crystals are placed at the bottom of the vessel containing the water, it will be weeks before they dissolve, unless the water is heated and agitated.

Bluestone when used alone, and not in combination with lime or lime-water, very injuriously affects the germinating power of the seed. Under some conditions, as much as *half the seed treated is destroyed*, or the vigour of the resulting plants so weakened that they are practically valueless. The *ill-effects* can be almost *entirely prevented* by sprinkling

the treated seed whilst wet with air-slacked lime or wood ashes, or by immersing it for a few minutes in lime-water. Lime-water is made by mixing *freshly-burnt* (lumpy) lime in water, say 2 lb. of unslacked lime in 20 gallons of water. If freshly-burnt lime is not available, the seed should be sprinkled with air-slacked lime or wood ashes. AIR-SLACKED LIME IS NOT SOLUBLE IN WATER, AND THEREFORE LIME-WATER CANNOT BE MADE BY MIXING AIR-SLACKED LIME AND WATER TOGETHER.

An advantage of the bluestone treatment is that the bluestone solution does not deteriorate, but it can be used over and over again during the whole season. The quantity in the cask or other vessel becomes less on account of a certain quantity being absorbed by the wheat treated—about 1 gallon for each bushel treated. The quantity used can be replaced from time to time by adding a definite quantity of water, say 5 gallons (50 lb.), and a definite (weighed) quantity of bluestone, say 1 lb. All that is necessary is to pour the requisite quantity of water into the cask or trough some hours before it is required, and then suspend the weighed quantity of bluestone just below the surface of the liquid. The vessels used for holding the bluestone solution should not be constructed of metal, nor should metal be used in the construction of any part likely to come in contact with the solution.

The Formalin Treatment.

Formalin is the trade name given to a solution containing 40 per cent. of formaldehyde dissolved in water. It is a powerful fungicide, and is more popular in the United States of America as a preventive of "smut" than it has yet become in this State, where it is as yet in the experimental stage.

The directions for treating seed with formalin are:—Make a solution of formalin by adding 1 lb. of 40 per cent. formalin to 45 gallons of water. Immerse the seed to be treated in this solution for five minutes, or sprinkle the solution over the grain, previously spread out on a floor or other hard surface, using about 1 gallon to each bushel of grain. The grain is to be shovelled over until thoroughly wet, and left in a heap for two hours, when it is ready to be planted.

As formalin is only a volatile gas dissolved in water, it is necessary to see that the bottle containing the formalin is securely corked or stoppered in order to prevent it deteriorating in quality. For the same reason it is desirable that only the quantity of solution required for immediate use should be made up. On account of the desirability of conforming to this condition, the sprinkling method is likely to be the most general wherever the formalin treatment is adopted. It is also desirable that the formalin should be kept from exposure to the light, and that the vessel containing the bulk be shaken up prior to the removal of any of its contents.

The experience of those farmers who have tried the formalin treatment indicates that the "rough and ready" methods which can be adopted with bluestone cannot be practised with formalin; the same amount of latitude with regard to the strength of the solutions is not permissible. It is therefore necessary to make sure that the formalin, when purchased, is of the stated strength, viz., 40 per cent. If below this, the solution

The Hot-water Treatment.

The water is kept at a temperature varying between 132° and 135° Fah. for fifteen minutes. If the temperature reaches 140° Fah. the wheat should be removed after five minutes.

when made up will be too weak, and is unlikely to kill the smut spores; if above it, the solution will be too strong, and is likely to impair the germinating quality of the seed-grain. For the same reasons, it is also necessary that the respective quantities of formalin and water be *accurately* measured, and not guessed.

When properly mixed and used the injurious effects upon the seed are not nearly as great as when bluestone is used alone and without the combination of lime or ashes.

The Hot-water Treatment.

This method has never become popular with our farmers. Without special conveniences it is troublesome, "messy," and slow, and requires an amount of care and attention which our farmers are not willing to give. Seeing that the other methods are as effective, and less troublesome, the hot-water treatment is never likely to become general or popular with our farmers. The treatment is effective, and consists in immersing the grain in hot water, which is maintained at a temperature ranging between 132 degrees to 135 degrees Fahr., for fifteen minutes, and afterwards plunging the seed in cold water. Should the temperature rise to 140 degrees or 145 degrees, the time of immersion should be reduced; at the latter temperature, an immersion of five minutes will be quite long enough.

A modification of this method, viz., soaking the seed for two hours in cold water and then subjecting it to the hot-water treatment for five minutes, is said to be the only preventive of "loose" or "flying" smut.

Ineffective Treatment.

Complaints are sometimes heard that the treatment adopted has not been preventive. When these complaints are investigated, it is usually found that the failure is either due to the use of an inferior quality of bluestone, to the want of thoroughness in carrying out some of the details of the treatment, or to reinfection being brought about after the treatment by putting the treated seed in bags or implements which have previously held smutted seed and which have not been cleaned of smut spores. Occasionally there is placed on the market what is reputed to be bluestone (copper sulphate), but what is really ferrous sulphate mixed with a small percentage of copper sulphate (bluestone).* This being sold to the farmers as genuine bluestone, it is used by them in good faith, with very unsatisfactory and disappointing results. In order to prevent loss from this cause, it is advisable to purchase supplies from a reputable firm who will guarantee the quality of the bluestone supplied. If this guarantee cannot be obtained, and there is any doubt as to the genuineness of the article supplied, a sample should be sent to the Chemical Branch, Department of Agriculture, Sydney, for analysis.

The loss and dissatisfaction caused by want of thoroughness in carrying out the details of the treatment is in the operator's own hands, as is also

* Mr. F. B. Guthrie, Chemist, Department of Agriculture, analysed samples of a substance which had been offered for sale as copper sulphate (bluestone). It was found to contain only 12½ per cent. of copper sulphate and 87 per cent. of ferrous sulphate. It was quite unsuitable for use as a fungicide.—*Vide Agricultural Gazette*, July, 1897.

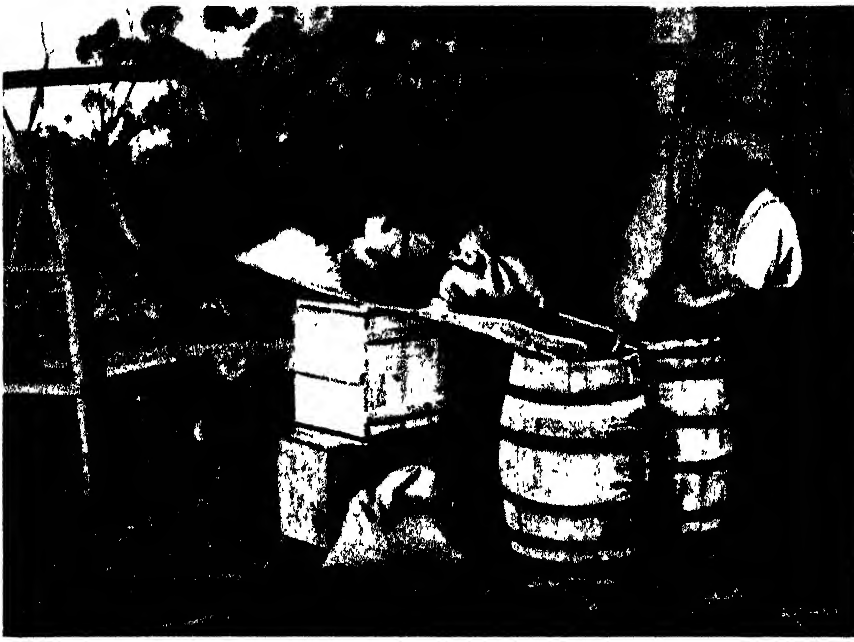
the remedy for the trouble caused through reinfection. Bags which are to hold treated grain should either be new or else should be treated in the same manner as the seed. Seed-drills, or other implements parts of which are metal, if likely to contain spores, should be swabbed out with a strong, say a 10 per cent., solution of formalin.

Drying.

Other Smuts.

The methods described for the prevention of wheat "smut" are also suitable for the prevention of oat and barley smuts. As bluestone has a specially injurious effect upon the germinating power of the oat-grain, it is advisable to use either the formalin or hot-water treatment for the prevention of smut in oats.

No method has yet been devised to effectually prevent maize smut. Treating the seed with a fungicide is of no value. The only measures of a beneficial character which can be adopted are those of a precautionary



Pickling Wheat with Bluestone.

nature. Smutted maize should not be fed to stock, as the disease is likely to be spread by the manure. Ears which are smutted should be collected and destroyed before the spores become scattered.

Wheat at the Royal Agricultural Society's Show, Easter, 1906.

F. B. GUTHRIE.

At the recent Show, held in Sydney last Easter by the Royal Agricultural Society, the Council went to some trouble to make the exhibit attractive and instructive. As in the past few years, the judging was based on the actual behaviour of the samples in the model mill of the Department of Agriculture. In addition, an exhibit was prepared in the Farm Produce Pavilion, in which the competing samples were shown, cards being attached to each bag, showing the results obtained by the actual milling of the wheat, and of the testing of the flour obtained. Samples of the mill-products, bran, pollard, and flour, were also shown alongside the wheats, so that each competitor, or anyone interested in the subject, could not only see the reasons which influenced the judges in forming their decision, but also the actual results obtained on milling the individual samples.

The result was a very considerable increase in the number of samples competing in the various sections, the number of exhibits being this year 37, as against 22 in 1905.

The classes were four in number:—

No. 666 for macaroni wheats.
,, 667 for hard or strong flour wheats.
No. 668 for medium hard wheats.
,, 669 for soft or weak flour wheats.

A first prize of £7 and a second of £3 was awarded in each class, and a Champion Prize of £3 3s. for the best bag of wheat exhibited in any class.

The judging was entrusted to Messrs. R. W. Harris, head miller, Gillespie Bros., Anchor Mills, Sydney, and F. B. Guthrie, Chemist, Department of Agriculture.

The actual milling of the samples was carried out by Mr. G. W. Norris, on the small model mill in the laboratory of the Department of Agriculture.

The following is a copy of the judges' report.

The Secretary, Royal Agricultural Society.

Dear Sir,

The methods of judging the exhibits competing for the Champion prizes was as follows:—A preliminary inspection of the samples in the various classes was made and the bushel weights of all the samples taken, those wheats being rejected which were manifestly of inferior quality or outclassed, or for any other reason ineligible for a prize.

The remainder were milled and marks assigned to each sample in accordance with the results obtained in the mill, the wheats being tabulated in order of merit according to their figures.

The tabulated results in each class are herewith presented separately, the figures in *italics* and within brackets being the actual numbers obtained on milling, the marks assigned being in Roman figures.

It must be understood that the marks are assigned only as between wheats of the same class. It does not for example follow that the wheat which gained the first prize in the macaroni class (666) and which received 98 marks was a better milling wheat than the recipients of the first prizes in the other classes, none of which received more than 97 marks.

Our thanks are due to Mr. G. W. Norris, of the Department of Agriculture, who carried out the milling tests in all cases.

WEIGHTS PER BUSHEL.

Class.	Catalogue No.	lb. per bushel.
666. (Macaroni wheats).....................	3721	65¼
	3722	64¾
	3723	65¾
	3724	66
667. (Hard, or strong-flour wheats.)	3725	63¾
	3726	64½
	3727	62½
	3728	64
	3729	66½
	3730	64¾
	3731	64½
	3732	63¼
	3733	62½
	3734	62¼
668. (Medium hard wheats)............	3735	64¾
	3736	64¾
	3737	64¾
	3738	63¾
	3739	64¼
	3740	64¼
	3741	65¼
	3742	65¾
669. (Soft, or weak-flour wheats).	3743	65¾
	3744	66½
	3745	64½
	3746	64¼
	3747	64¾
	3748	63
	3749	62½
	3750	63
	3751	65¾
	3752	65
	3753	64¼
	3754	65
	3755	64½
	3756	65½
	3757	62

RESULTS OF PRELIMINARY EXAMINATION.

CLASS 666 (Macaroni Wheats).

Of the four samples exhibited, No. 3,724 was rejected, being of inferior appearance, and containing much white soft grain and barley. Nos. 3,721, 3,722, and 3,723 were milled.

CLASS 667 (Hard, or Strong-flour Wheats).

Nos. 3,731, 3,733, 3,725, and 3,726 were not examined in the mill, Nos. 3,733 and 3,725 not being up to the standard, and Nos. 3,726 and 3,731 being soft white wheats, and consequently outclassed. Nos. 3,729 and 3,730 are also outclassed, being medium hard wheats, consequently marks could not be assigned for appearance; they were, however, milled, and the results given in the table. No. 3,729 was a particularly good sample, and had it been entered in its proper class (668) it would undoubtedly have received a prize in this class.

CLASS 668 (Medium Hard Wheats).

Nos. 3,736, 3,737, 3,738, and 3,740 were not milled, being inferior grain or outclassed.

CLASS 669 (Soft, or Weak-flour Wheats).

Nos. 3,743, 3,748, 3,749, 3,750, 3,756, and 3,757 were rejected as being ineligible for prizes, being inferior samples. No. 3,743 was a bunty sample. There was also a little bunt in No. 3,745 (a milled sample). No. 3,752 is outclassed, but was milled, and the figures given, except for appearance, for which no marks could be assigned, as it is a different type of wheat.

RESULTS OF MILLING TESTS.

	Appearance of Grain.	Weight per Bushel.	Ease of Milling.	Percentage of Flour.	Colour of Flour.	Percentage of dry Gluten.	Strength.	Total.
Maximum Marks	15	15	10	10	10	20	20	100
Class 666.								
Catalogue No.								
3723	15	15 [65¾]	10	10 [69·1]	10	18 [11·6]	20 [48]	98
3722	13	13 [64¾]	10	8 [67·5]	9	20 [13·1]	19 [46·8]	92
3721	11	14 [65¼]	10	9 [62·2]	10	18 [11·8]	19 [47]	91

Class 666—First Prize, No. 3723 ; Second Prize, No. 3722.

Class 667.								
3734	15	13 [62½]	10	9 [71·1]	8	20 [14·6]	19 [52·6]	94
3728	12	15 [64]	10	9 [71·1]	9	17 [12·4]	17 [51·2]	89
3727	10	13 [62½]	10	8 [70·5]	8	18 [12·7]	20 [56]	87
3732	9	14 [63¼]	10	10 [73·2]	8	16 [11·7]	20 [56]	87
3730	.....	15 [64¾]	10	9 [71·5]	8	17 [12·2]	20 [55·4]	....
3729	.....	15 [66½]	10	10 [73·0]	10	14 [7·8]	19 [52·5]	

Class 667—First Prize, No. 3734 ; Second Prize, No. 3728.

Class 668.								
3741	12	14 [65¼]	10	10 [74·6]	8	20 [13·8]	20 [55]	94
3739	15	12 [64½]	10	9 [71·5]	9	18 [10·0]	19 [54·0]	92
3735	11	13 [64¾]	10	9 [71·2]	9	18 [10·0]	15 [50·5]	85
3742	10	15 [65¾]	10	8 [69·1]	10	18 [10·2]	14 [47·0]	85

Class 668—First prize, No. 3741 ; Second prize, No. 3739.

Class 669.								
3744	15	15 [66½]	10	10 [72·4]	10	18 [8·9]	19 [50]	97
3751	14	14 [65¾]	10	10 [72·7]	10	19 [9·5]	17 [48·5]	94
3747	14	13 [64¾]	10	8 [70·3]	8	19 [9·6]	20 [51]	92
3746	11	12 [64½]	10	9 [71]	10	20 [11·0]	18 [49]	90
3745	12	12 [64½]	10	8 [70·5]	7	17 [8·5]	16 [48·0]	82
3754	9	13 [65]	10	8 [70·8]	8	19 [9·7]	14 [45·8]	81
3755	8	12 [64½]	10	9 [71·4]	6	15 [7·8]	15 [47·0]	75
3752	—	13 [65]	10	7 [69·3]	5	20 [13·5]	19 [50·0]	—

Class 669—First prize, No. 3744 ; Second prize, No. 3751.

Awards.

Class 666. (Macaroni wheats.)	First prize, No. 3723, W. G. Reinhard. Second prize, No. 3722, Iandra Estate.
Class 667. (Hard, or strong-flour wheats.)	First prize, No. 3734, W. G. Reinhard. Second prize, No. 3728, W. Fuljames.
Class 668. (Medium hard wheats.)	First prize, No. 3741, A. B. Smith. Second prize, No. 3739, W. G. Reinhard.
Class 669. (Soft, or weak-flour wheats.)	First prize, No. 3744, Clinton Bros. Second prize, No. 3751, George Lindon.

Champion Prize, for best bag of wheat exhibited, No. 3744, Clinton Bros.

F. B. GUTHRIE.
R. W. HARRIS.

The Secretary of the Royal Agricultural Society kindly supplied the following information concerning the principal prize winners, which will be of interest to contributors :—

Class 666.—Wheat, Macaroni, 3 bushels.

First Prize, Reinhard, W. G. (3723) Wellington ; variety Macaroni ; grown at Oddfield, near Wellington, on chocolate soil ; ½ bushel seed per acre, yield 16 bushels per acre.

Second Prize, Iandra Estate (3722) Grenfell ; variety Macaroni ; grown at Iandra, Grenfell, on deep chocolate soil ; 30 lbs. seed per acre, yield 30 bushels per acre.

Class 667.—Wheat, Hard or Strong Flour, 3 bushels.

First Prize, Reinhard, W. G. (3734) Wellington ; variety Manitoba ; grown at Oddfield, near Wellington, on chocolate soil, 1 bushel seed per acre, yield 12 bushels per acre.

Second Prize, Fuljames, W. (3728) Tamworth ; variety Manitoba ; grown at Calala, near Tamworth, on heavy black soil, ¾ bushel seed per acre, yield 4 bags per acre.

Class 668.—Wheat, Medium Hard, 3 bushels.

First Prize, Smith, A. B. (3741) Duri ; variety Bobs ; grown at Duri on black soil ; ½ bushel seed per acre, yield 12 bushels per acre.

Second Prize, Reinhard, W. G. (3739) Wellington ; variety Bobs ; grown at Oddfield, near Wellington, on chocolate soil ; 1 bushel seed per acre, yield 24 bushels per acre.

Class 669.—Wheat, Soft or Weak Flour, 3 bushels.

First Prize, Clinton Bros. (3744) Corowa ; variety Steinwedel ; grown at Eurena, Corowa, on stiff clay ground ; 20 lbs. seed per acre, yield 20 bushels per acre.

Second Prize, Lindon, George (3748) Wagga Wagga ; variety Jade ; grown at Gobbagombalin, near Wagga Wagga, on loose chocolate soil ; 35 lbs. seed per acre, yield 28 bushels per acre.

Champion Prize, for best bag of wheat exhibited :—

Clinton Bros. (3744.) See above.

Farmers' Fowls.

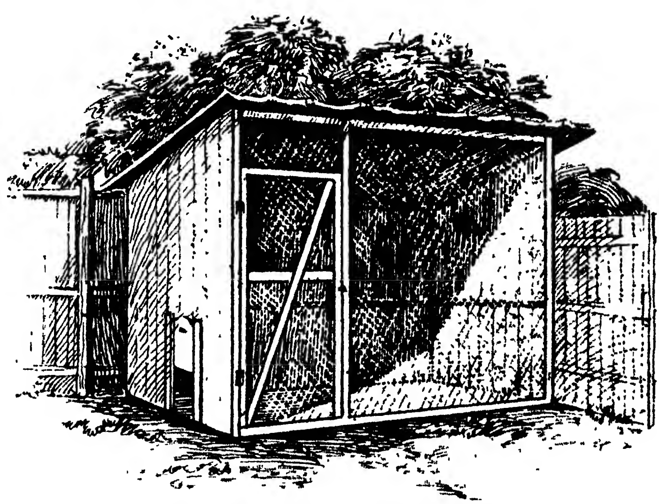
[Continued from page 723.]

G. BRADSHAW.

CHAPTER XL.

Houses, &c.

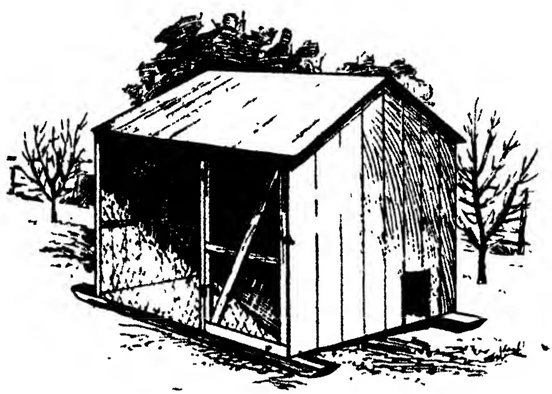
COMING to the structures best suited for Farmers' Fowls, the chief consideration will, necessarily, be cheapness, consistent with practicability; and it is on the farm and about the farm-house where the above requirements are most easily had.



A cheap fowl house, wire netted front, bark roof.

I should first say that the best results will be obtained by open-fronted buildings, the ordinary lean-to house—a back, two ends, and open front, and overhead covering—being all that is necessary. The most inexpensive protection can be erected in some corner of the farm yard, the ordinary paling fence forming the back and end of house, leaving but one end to erect, the front being open; the further this end is kept from the right-angle fence the house will, of course, be the larger, and accommodation can be had for any number of fowls in relation to the distance this end is kept from the fence which forms the other end. The roofing timber, such as joists, &c., can all be had on the farm, while for the roof, cheapness being the object, bark can be had on most farms, and while admitting that such may not make a picturesque fowl-house covering, still, for practicability and comfort, it suits excellently; nor is it anything to be ashamed of, seeing that this product of the bush has formed

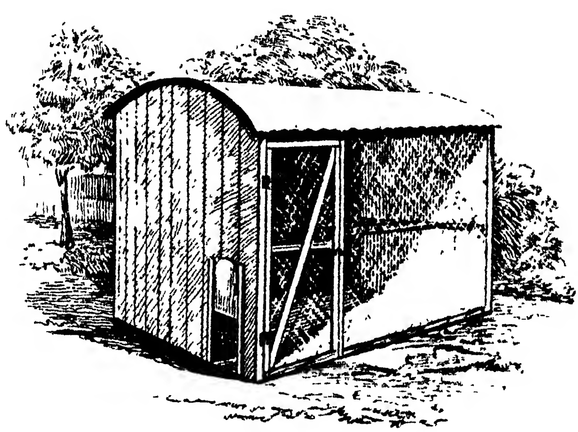
the parental roof of many present-day happy and prosperous farmers. At the same time, although the bark roofing be watertight, this and the paling walls will not constitute a healthy hen house, arising from the fact that such a structure would be most disastrous to the inmates by the draughts coming through the openings between each paling; indeed, rather than recommend this rain-proof structure, it could be safely asserted that the fowls would be more healthy roosting on the fences in the open air. The most dreaded of all poultry diseases is roup, of which a cold is the forerunner, the latter in many instances being induced not by the lowness of the temperature, for while a single specimen, or a whole flock of poultry, may be healthily and profitably kept in open-air conditions below freezing point, this same flock if in a draughty roosting-house colds would be induced at any temperature from 50, 60, or more degrees; and, on the other hand, the house may be so stuffy, close, and



A movable fowl house on runners.

otherwise insanitary, that the almost tropical temperature of 80 or 90 degrees F. has been responsible for roupy troubles. To make the above improvised fowl-house draught proof, such can be readily done. On almost every homestead there are a number of old waste corn bags or sacks. These can be cut open, and will make an excellent lining for the house, and should be tacked right round, and from the floor up to considerably above the perches, which should not be more than at most 2 feet from the floor. It may be rightly said that this lining would be a harbour for vermin; however, that is easily provided against. The following recommendations, if carried out, will be effective in making the place vermin proof:—To give the inside of the house, the palings, a good coating of coal tar, and tack the bags on before this dries, and another coat of tar on them after being fixed. The latter repeated each season would contribute to a clean and healthy house; but, unfortunately, the tar is not readily obtainable at the bulk of the farms. However,

other more readily obtained applications are effective, of which the following, for simplicity and cheapness, cannot be improved on. Everyone knows how to make whitewash, and that it is best made with fresh lime and boiling water. To a bucket of limewash, when hot, add say, a quart of kerosene, mix thoroughly, and give the palings a good coating, the following day a second application; after this the bags can be fixed, finishing up by giving these a good coating of whitewash, which will contribute to clean, healthy, sanitary quarters. The perches, also the product of the farm, should get an occasional painting with kerosene, and the inside of the house a whitewashing at least once a year. In districts where native cats, foxes, or other enemies of the poultry yard prevail, the entire front of house, including door, should be wire netted, thus providing that the fowls could be secure at night and kept safe from the, at times, serious depredations of the above. A roosting-house con-



A serviceable fowl house, curved iron roof.

structed as described, the materials of which are obtainable on the farm, the lime and kerosene excepted, costs almost nothing for labour, materials free, will last for years, and, if other conditions be right, will house and accommodate a flock of prize or other fowls more comfortably and healthily than is done in the buildings constructed under the supervision of the most competent architect, whose fee alone, on what is known as up-to-date poultry plants, would be more than the value of the entire stock of many a farmer's fowls.

However, there are many of those on the land who make a point of not only having their dwelling architecturally and artistically correct, but the farm offices or out-houses as well, and to those whose taste and purse tends to that end the several drawings of poultry houses which appear in English poultry works and journals will appeal, and from which a selection can be made, always remembering that the bulk of them have been designed for colder climates than ours, and to adapt them to

Australian conditions will involve considerably more ventilation than is provided in the majority of them.

The various designs are of tongued and grooved boards, would require a carpenter to make, and would cost from 30s. up to as high as £5. In the United Kingdom, one of the most profitable branches of poultry breeding is that adopted by farmers in hatching a quantity of chickens during the latter end of May, June, and July. This, although late to realise the best price at selling time, are more profitable than the early ones withal. These chickens are fairly well grown at harvest time, and, when the wheat and oats are removed to the farm yards from the fields, the hens and chickens are turned out to the stubble, where they find almost their entire food from the grain which has been shaken out of the ear by the wind, or during the operation of harvesting. Of later years, manufacturers have come to the farmers' aid in this respect, by putting on the market what is known as portable houses, some on wheels, and others on slides. These are, in reality, a camp-out for the fowls. These houses are filled to accommodation at night with the half or three-quarter grown chickens, and, in some instances, laying hens. A horse is yoked to it in the morning, and the establishment removed to some portion of the stubble field; the house is opened in the morning, when the inmates betake themselves to the stubble for their grain and insect breakfast, and continue throughout the day looking for and finding a living, the fowls, even the first night, going readily to their new quarters. Should there be much cast grain on the ground, the house is allowed to remain several days at this spot, while in the event of it being a poor feeding ground the house is removed each morning to a more rich feeding place. In some instances, supplied food is given once a day, in others, the fowls thrive and put on flesh on what they gather. In this country, such a profitable practice does not obtain; possibly our wheat growers are in such a big and prosperous way that they think fowls are too small a thing to trouble about. At the same time, realising that this State paid considerably over £30,000 last year for imported eggs, a portion of this would surely not be objected to when such could be assured by the small efforts of building a few portable houses and purchasing a stock of young laying hens. But, even did the wheat growers object to be bothered about hens, there are always the farm labourers and other way-side residents who, with the initial low-cost portable houses, and stocked with even the too common sort of fowls, could readily get permission of any of these large stubble areas, the laying, growing, and fattening from this free-food system being largely all profit. Indeed, with the extraordinary acreage in some of these New South Wales wheat paddocks, a large poultry farm on wheels could obtain for almost three months in the year. A variety of poultry houses as used in England are shown, but with a wire-netted front to suit the altered conditions of this country.

(*To be continued*).

Dairy Science Class, 1906.

In accordance with the usual practice of this Branch, a Dairy Science Class for factory managers was held at the Government Dairying Laboratory, Sydney, during July. Fourteen young men attended the course, but one, who had done well—Mr. Graham, of Bellinger—had to leave before examination day. They all did good work, and to show the nature of the examination paper set, as well as to give an idea of the standard reached, the answers of the two students, who had obtained highest marks in theory, are here given.

Examination Paper.

Answers by Students.

1. Explain why it is that the cubic contents of the graduated neck of a cream flask which represents 6 c.c. shows a reading of 30 per cent. of fat.

2. If a cream tested 33 per cent. by measured sample (Babcock method) and the specific gravity of the cream is given as ·997, what was the actual percentage of fat in that cream?

3. Describe a process for detecting the presence of boric acid in butter, and of formalin in cream.

4. Describe a method for determining the acidity of a milk or cream.

5. Describe a method for determining the amount of water in butter—

Given a dish weighing	15·432 grams.
Dish with butter in	18·932 ,,
Dish after moisture has been expelled...	18·512 ,,

What was the percentage of water in the butter?

6. Give briefly the reasons why the presence of certain species of bacteria in the dairy water supply may affect the quality of the butter.

7. Explain the part which lactic acid producing bacteria play in butter-making and in controlling the flavours of butter.

8. What are bacteria? State the conditions necessary for their development and the means or methods by which such development may be controlled.

Replies by Mr. E. K. Allen.

1. The specific gravity of butter-fat is ·9 at about 140°F., which is about the temperature to read tests, therefore 6 c.c. of fat will be 5·4 grms., which is 30% of the 18 grs. of cream and water put into the flask, or it is 60% of the 9 grs. taken to be tested. Or in other words assuming 6 c.c. = 30%—

$$6 \text{ c.c.} = 30\% \text{ of whole}$$

$$\therefore 6 \text{ c.c.} = \frac{30}{100} \text{ of } 18$$

$$\therefore 6 \text{ c.c.} \times \cdot 9 = \frac{3}{10} \times 18$$

$$\therefore 5{\cdot}4 = 5{\cdot}4$$

2. With measured cream testing 33% with specific gravity of ·997 in 8·75 c.c. we only take 8·72375 grs., whereas we should have taken 9 grs. Therefore if 8·72375 grs. give a reading of 33%, 9 grs. will give a reading of 34%, which is the correct % of that cream.

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872375) 2970000 (34·0%        33% × 9          33
        2617125              ·997 × 8·75        9
        -------                    997        ---
         3528750                   ---        297
         3489500                  6125
         -------                 7875
          ··39250               7875
                                -------
                                8·72375
```

3. Take a small test tube and put in a small quantity of the butter to be tested, then melt the butter in a water bath, and add a little hot water to the butter, cork the test tube up and turn upside down and allow the butter to cool, then the water is easily drawn off; if the butter contains boric acid, so will the water which has been mixed with it, so we proceed to test the water—

Take 1 drop of the water,
1 „ HCl, or spirits of salts,
1 „ Turmeric,

mix together and dry the mixture over a steam jet or any heater, when dry and cool add 1 drop of liquid ammonia; if boric acid is present it will turn blue and gradually go black, if not present it will not change.

For formalin in cream.—Take small quantity in a test tube and add about the same amount of H_2SO_4 or sulphuric acid; if there is formalin present, where the acid meets the cream it will turn a purple colour, if not present it is generally a light green.

4. To determine acidity in cream we must have an alkaline solution of a known strength. Say we have a normal solution, or one of which 1 c.c. will neutralise ·01 grs. of lactic acid. We take 10 c.c. of cream to be tested, make sure to get the 10 c.c. by washing out the pipette with water, add 3 drops of phenolphthalein which acts as an indicator as to when the acid is neutralised, then you run your solution in until you have received a permanent pink colour in your cream, and the amount of solution taken divided by 10 gives amount of lactic acid—thus if you use 6·5 c.c. of solution your reading will be ·65.

5. Weight of dish and butter	18·932	
„ „ „	15·432	
	3·5	grs. of butter.
Weight of dish and butter before drying ...	18·932	
„ „ „ after drying ...	18·512	
Loss of moisture	·42	grs.

It has lost ·42 grs. of water from 3·5 grs. of butter; therefore 100 grs. will contain more.

$$\frac{\overset{10}{\cancel{100}} \times \cdot 42}{\underset{\cdot 35}{\cancel{3 \cdot 5}}} = \% \text{ of water} = \frac{10 \times \cdot 42}{\cdot 35}$$

= ·35)4·200(12 % of water. *Answer*—12 %.
3 5

. 70
70

6. If the dairy water supply contain certain species of bacteria, they affect the butter in different ways. Some destroy the keeping qualities, and some destroy the flavour. Take *Oidium lactis*, for example: it may get into cream in various ways—either by washing vessels containing cream with water containing them, and by washing separator with the water, and by washing butter with it, but more especially when milking. On hot days the cows are generally standing in swamps or dams, when, if there are any present, they will stick to the cow's udder after the sun has dried the cow, so they will readily be knocked off into the bucket when milking, and so are carried as far as to the butter, where after a time they will impart a strong fishy flavour. Others, again, in ripe cream attack the casein, and in time coagulate it, giving us what is known as mottled butter. Others create a bad smell in cream, thereby taking away the nice aroma of good butter and spoiling the flavour.

7. The lactic acid bacteria play an important part in butter-making, inasmuch as they ripen our cream for churning. But, if allowed to go too far, they have a very deteriorating effect on butter, inasmuch that they produce too much acid from the milk sugar, and then attack the casein; also, when they have produced a large amount of acid they, as it were, go to sleep, thereby giving the more virulent types of bacteria a clear field for work, which they begin by attacking the casein. They control the flavour of butter, inasmuch as they crowd out nearly all other bacteria, and nearly all organisms do not like the acid they produce, thereby keeping putrefactive organisms from spoiling the flavour as fast as they would if the lactic bacteria were not present. But they do not control the *Oidium lactis* which produce fishiness, as they love lactic acid, and will work well with the lactic bacillus.

8. Bacteria are the lowest form of vegetable or organic life, containing no chlorophyll, as ordinary plants do, which enables them to get food from the air. Therefore bacteria live on matter such as casein and also on sugar. Milk is the best media for bacteria. They require warmth, food and moisture for their development. Water is not as good a media, as it does not contain as much food as milk. The development of bacteria may be controlled by either extreme cold or heat. But some require more cold than others. This does not get rid of them altogether as they will begin to propagate again as

soon as sufficient warmth is obtained. Again, some require greater heat than others, in fact some of the most virulent type which produce spores or seeds will stand boiling. Therefore to do what we call sterilise milk we have to heat a second time, and sometimes three and four times, then there are rare cases in which it will not be sterile. Thereafter heatings are necessary, because we only kill the growing plant, and so we have to wait till the spores of seeds become growing plants and then kill them.

Replies by Mr. W. E. Fackender.

No. 1. 6 c.c. = 30 per cent. whole ; therefore
$6 \text{ c.c.} = \frac{30}{100} \times 18$ grammes ;
$6 \text{ c.c.} = \frac{3}{10} \times 18$;
$6 \text{ c.c.} = \frac{54}{10}$;
6 c.c. = 5·4 ;

but as one is measure and the other volume, and volume multiplied by sp. gravity gives weight, hence 6 c.c. × ·9 (sp. gravity fat at 120° Fah.) = 5·4, therefore 6 × ·9 = 5·4 = 5·4.

No. 2. 100 lb. cream-testing 33 per cent. measure, will equal measure × sp. gravity, or 8·75 × ·997 = 8·72 grammes weight taken ; then, as 8·72 grammes gives 33 lb. fat, what will the correct weight 9 grammes give?

$$\frac{33 \times 9}{8{\cdot}72} = 34{\cdot}06,$$ the true percentage in cream.

No. 3. Take test tube, say 25 per cent. of tube, with butter ; add 25 per cent. water ; melt and shake well, cork tube and turn upside down, cool under tap of cold water. When butter firm, take drop of water from under the butter and add one drop muriatic acid, HCl, one drop turmeric, dry over oven, then add one drop liquid ammonia. If a blue colour is formed boric acid is present.

Take a quantity of cream in a test tube, add same quantity of water, then add some sulphuric acid, and if a violet-coloured ring is formed, formalin is present.

No. 4. The acidity of milk or cream is determined by measuring 10 c.c. of milk in a porcelain or glass dish, and a few drops of solution of phenolphthalein in alcohol, and an alkali solution (of a known strength) is run in from a burette. The most convenient strength of the soda caustic solution is such that 1 c.c. will neutralise ·01 lactic acid ; then the number of c.c.'s taken to turn milk or cream to pale pink is the percentage of lactic acid.

No. 5. 18·932 - 15·432 = 3·5 grammes butter taken ;
then 18·932 – 18·512 = ·42 loss on 3·5 grammes ;
then $\frac{42 \times 100}{3{\cdot}5} = 12\%$ moisture.

No. 6. The presence of undesirable bacteria in water will affect the quality of the butter in many ways—such as cattle standing in water over their udders to drink, as is frequently the case, carry micro-organisms from there to the milk bails ; and then, in drying, the dust from udders falls into the milk pail, and contamination will at once begin. This cause is one of the most common

in regard to milk, and hence, unless pasteurised, and then not successfully to the butter, these undesirable micro-organisms are carried to spoil flavour and keeping qualities of the butter made.

Then there is contamination from washing dairy utensils with bad water, and the washing of butter with water that is not sterile. The organisms attach themselves to the casein in the butter, and putrefaction of the casein sets in, causing eventually rancidity of the butter.

No. 7. Lactic acid is caused by the action of lactic acid bacteria attacking the milk-sugar of the cream, producing a nice clear sour taste in the cream, that will give a fine flavour to the butter if lactic acid is controlled, and not more than ·7 is allowed to develop in the cream; if more than this quantity is allowed to develop, its own acid will eventually retard the growth of the lactic acid bacteria, and then other undesirable organisms take a hand and multiply, attack the casein, producing, while decomposing same, offensive taste and rancidity in the butter.

If a large percentage of lactic acid be present, the *Oidium lactis* will also develop, as they are fond of lactic acid, eventually producing fishiness in cream and butter.

No. 8. Bacteria are the lowest form of vegetable life, and capable of reproduction in twenty minutes under favourable conditions. They require food like all other plant life. They also cause the decomposition of all matter. They are therefore great scavengers and cause all fermentations.

There are aerobic and anaerobic microbes, the first requiring oxygen, and the latter will thrive without air. The anaerobic are generally detrimental organisms.

The ordinary atmospheric micro-organisms are not putrefactive.

Bacteria develop best at about blood heat, and of course they require suitable food—milk especially, is a splendid medium.

Both heat and cold affect the conditions necessary for their development, and if dairy produce is held at 20 degrees Fah., bacterial development is practically stopped. Also, if heat is applied at 180 degrees Fah., for twenty minutes, the bacteria are destroyed, but not the spores; but lactic acid bacterial life is destroyed, as they have no spores; hence the necessity of introducing lactic acid bacteria to a pasteurised cream in the form of a starter. If not, the more virulent organisms will attack the cream, and same would have been better had it not been heated. Light is also very detrimental to conditions necessary for their development.

HOLSTEIN BULL "UNITED STATES."

By Garfield (imp.) from Nobeltje (imp.

First prize at last Sydney Show and first at Hawkesbury Show

Bred at the Government Stud Farm, Berry; now the property of Mr. S. Cornwell, who has used this bull on his dairy farm, on the Richmond River.

Dairy Notes.

The Brisbane Show.

M. A. O'CALLAGHAN.

THE Queensland National Show of 1906 is over. As I sit here reviewing the various items in connection therewith, what is it that stands out from its fellows? The marvellous high jumping; the excellent horse and cattle parade; the daring horsemanship of the lady hunters; or the well-dressed,

Judging Jersey Cows.

well-behaved huge crowd that attended on the day of the official opening, when the Governor-General and the State Governor attended. These are all indelibly impressed on my memory; but there is one more so, and this is the order and promptitude which the ring-stewards maintained right through the four days during which the exhibition lasted.

New South Wales was well represented, and wherever one turned the face of a New South Welshman was to be met. The dairy-farmers from the Richmond and Tweed came and brought their cattle. They have returned and have taken back Queensland money from the prize and the sale rings. Mr. Dixon Cooke, of Alstonville, had a few choice specimens of Dairy Shorthorns up, and these, after carrying off chief honours in

their sections, all met with good inquiry, and they remain behind to enrich Queensland cattle blood. The best animal left behind, however, was, perhaps, a young roan bull bred by Mr. Frederick, by "Cornish Boy 2nd," by the New South Wales Government imported bull "Cornish Boy," who left his mark on the Richmond River cattle. This is a beautiful young beast, and when he was knocked down for 43 guineas an enterprising New South Wales man offered £5 profit to the purchaser, who, however, declined to resell. Judging by the number of animals shown that are descended from New South Wales Government imported cattle, it would seem as though Queenslanders were going to benefit largely by these importations from Europe into the sister State. The Illawarra herds were also well represented, and Kiama-bred cattle, shown by Mr. Hardcastle, got the blue bands in their classes.

Then the champion dairy Shorthorn bull is an ex-Illawarra specimen, viz., the red bull "Belmore," now owned by Mr. McConnell, the manufacturer of "Cressbrook" condensed milk. Despite, however, the many worthy representatives of dairy Shorthorns, the dairy breed that stood out from all others was the Jersey. No better types have been seen on any show-ground in Australia, and the judge must have been at a loss at times for ribbons enough to decorate the animals worthy of merit. Mrs. J. McWhirter's "King Lear," imported, and Mr. R. McCook's "Distinction," were the most notable Jersey bulls present; but the cows outclassed the bulls in numbers and quality. Mrs. McWhirter's "Christmas Belle," imported, and Mr. O'Shea's "Grasfort Queen," imported, both looked well: but the latter being dry, and evidently specially fed, was a bit on the fat side, and showed somewhat leathery about the throat. She is a great stamp of a dairy cow, and it took a very good one to beat her; but "Christmas Belle" did the trick. Mr. O'Shea was, however, first in the aged-cow class with "Flora 15th," an island-bred cow. The same owner was first in the special class for three cows, the property of one owner, and he also won the championship with "Flora 15th," imported.

The Jersey breed of cattle has some enthusiastic supporters in Queensland, who have spared neither money nor trouble in the selection of the best specimens obtainable in England and in the island of Jersey. Many of the cows show great constitution, and it is hoped the judges of this breed at future shows will bear in mind the value of constitution in any dairy breed, but more especially in Jerseys, and so avoid any inclination to give premier honours to animals breedy and "classey" in type, but lacking in depth and constitution. "Weeds," even though they be pretty, are no use to the dairy-farmer.

The Ayrshire suffered in comparison with last year by the absence of the Gatton Agricultural College cattle. Dr. Hay's (New South Wales) cow "Mayflower" was easily the best Ayrshire female, and she won in her class and afterwards carried off the championship.

There were two very good Ayrshire bulls shown, both of them imported, viz., Mr. Philips' "Wigtown Boy," and Mr. McWhirter's "Forest Chief."

Each won in his class, and "Forest Chief," though the younger bull, was awarded the champion ribbon. Both bulls have considerably improved since last year, but "Wigtown Boy" is not quite in show condition.

Mr. Connelly, Richmond River, also showed some nice Ayrshires.

The Guernseys were represented by a couple of imported specimens typcial of the breed, but Holsteins, strange to say, were represented by only one entry.

Brisbane Show has become a great meeting place for Richmond and Tweed dairy-farmers, and for this reason alone it is worth while being present, from my point of view.

Illustration, "Judging Jersey Cows," kindly lent by the *Town and Country Journal.*

Monthly Weather Reports.

HAWKESBURY AGRICULTURAL COLLEGE.

SUMMARY for June, 1906.

Air Pressure (Barometer).			Shade Temperature.				Air Moisture Saturation=100.			Evaporation (from Water Surface).			
Lowest.	Highest.	Mean.	Lowest.	Highest.	Mean.	Mean for 14 years.	Lowest.	Highest.	Mean.	Most in a Day.	Total for Month.	Monthly Mean for 8 years.	% of year's evaporation.
29·60 26th.	30·63 11th.	30·15	29·8 25th.	72·5 21st.	53·363	51·38	47 29th.	100 4th, 5th, 6th, 13th, 14th, 15th, 16th, 17th.	80 3	·150 26th.	2·096	1·853	4·5

Rainfall ...	Dates	5	6	7	8	13	19	20	23	Total,	Mean Rainfall for 14 years.
	Points	9	14	9	1	5	2	12	9	61	2·173 points.

Wind ...	N	NE	SE	S	W	NW
	3	4	1	3	4	5

Greatest daily range of temperature, 34·6°, on 1st.

Frosts—2, 9, 24, 25.

Remarks:—On the 11th barometer rose to 30·64 in., the highest reading recorded here.

W. MERVYN CARNE,
Observer.

SUMMARY for July, 1906.

Air Pressure (Barometer.)			Shade Temperature.				Air Moisture Saturation=100.			Evaporation (from Water Surface).			
Lowest.	Highest.	Mean.	Lowest.	Highest.	Mean.	Mean for 14 years.	Lowest.	Highest.	Mean.	Most in a Day.	Total for Month.	Monthly Mean for 8 years.	% of year's Evaporation.
29·58 28th.	30·37 4th.	30·04	21·5 25th.	75·9 12th.	50·17	49·05	47 19th & 26th.	90 9th, 15th, & 20th	64	·128 18th.	2·55	1·889	5·5

Rainfall ...	Dates	14	20	30	Total,	Mean Rainfall for 14 years.
	Points	7	3	1	11	2·694 points.

Wind ...	N	NE	S	SW	W	NW
	4	2	1	1	8	6

Greatest daily range of temperature, 45·1°, on 5th.

Days on which shade temperature fell below 42° ... } This being the coldest month of the year, the temperature fell below 42° on all days but 2nd, 7th, 17th, 23rd, 30th, and 31st.
Frosts—3, 4, 5, 8, 9, 12, 15, 19, 21, 22, 24, 25, 26, 27, 28 ..

Remarks:—A very dry month, the rainfall being the lowest recorded for any one month, though equalled by that of August, 1905. Strong N.W.-W. winds towards latter end of month.

W. MERVYN CARNE,
Observer.

The Cattle Tick: Tick Infestation, Tick Fever, and Preventive Measures.

JAS. D. STEWART, M.R.C.V.S.,
Government Veterinary Surgeon.

Introductory.

THE manner in which the cattle tick has been introduced into Australia, and from whence it came, have not yet been definitely ascertained. It is, however, suspected that it came to Port Darwin from one of the islands of the Eastern Archipelago, and spread through the Northern Territory from that centre. It is said that the first cattle that went from Queensland to stock the Northern Territory became affected with tick fever upon their arrival at the Macarthur and Roper Rivers.

Normanton and Burketown in time became recognised centres of infestation. In 1894, Mr. C. J. Pound, the Queensland Government Bacteriologist, identified the disease that was disseminating the herds at Normanton, after carrying out an investigation there, as Texas or Tick fever. Owing to the stock traffic being diverted to the east coast of Queensland, in consequence of the meat works at these places closing down towards the end of that year, the tick spread along the main stock routes up to the Flinders River until it reached Hughenden. Infested stock trucked from Hughenden to Townsville carried the tick to the eastern coast of Queensland, establishing many centres of infestation, and gradually extended southerly until it reached the border of this State, about three years ago.

As soon as the tick reached the eastern coast of Queensland, measures were adopted by this State to prevent its introduction. Stringent regulations to control the importation of stock from Queensland were enforced, fencing was erected along the border, buffer areas were enclosed in dangerous localities, dips were erected, crossing-places gazetted, and a trained staff of inspectors and patrolling assistants placed in charge. These measures proved successful in preventing the invasion of cattle tick into this State for a period of ten years, and the recent appearance of ticks on cattle at Tweed Heads, on the 2nd of last month (August, 1906), is in no way traceable to their failure.

For the past five years all stock traffic from Queensland has been absolutely prohibited crossing the border for a hundred miles from the coastline, while the centre where the cattle have become infested and the character of the infestation indicate that the tick has been introduced in an uncontrollable manner.

Immediately the presence of the cattle tick was discovered at Tweed Heads, that portion of the State was at once isolated and quarantine restrictions applied to all stock therein. Energetic measures have been adopted within the affected area to eradicate the pest, while all stock on the Tweed River are being systematically and periodically inspected in order that any spread of the tick may be early detected and stamped out.

Although the problem of fighting the tick is one which has received special consideration by this Department, it is felt that successful results can only be obtained by stock-owners extending their loyal support and active co-operation. The first and most important step towards this end appears to be the educating of stock-owners as to the nature of the cattle tick, its effects on stock, and measures of prevention. With this object in view, the following article is written.

The Cattle Tick (*Boophilus Australis*).

Geographically, the cattle tick is widely distributed, and is known to exist in south of Europe, east of Asia, north, east, and south of Africa, in the West Indies, Mexico, Central and South America, Java, Borneo, Philippine Islands, Ireland, and Australia. It was first described in 1867 by Mr. C. V. Riley, late Entomologist of the Department of Agriculture, United States of America, under the name of "Ixodes Bovis." In 1891, C. Curtice, of the same department, suggested the genus "Boophilus," and the tick became designated "Boophilus bovis." Neumann, in 1897, regarded it as the "Rhipicephalus annulatus." The Queensland cattle fever tick was originally regarded as identical with that of North America, but recently it has been found to differ, and is now termed "Boophilus Australis". a seemingly appropriate designation.

The "Boophilus Australis" is said to be identical with that occurring in South America, Cuba, and Porto Rico. In Australia, cattle ticks are known to infest stock in the northern and portion of west coast of Western Australia, in the northern territory of South Australia and Queensland, along the eastern seaboard of Queensland, and, lastly, in the extreme north-eastern corner of New South Wales.*

Hosts.—The natural hosts of this tick are undoubtedly bovines, and it is upon cattle that they thrive best. It, however, attaches itself to horses, asses, and mules, and grows fairly prolifically. It has also been found to develop upon the face of sheep.

A fairly well matured cattle tick was found on a dog at Rockhampton by Mr. Veterinary Surgeon Barnes, and I know of one instance where it attached itself and developed for several days upon a human being; these, however, are isolated cases.

It is frequently stated that cattle ticks have been found infesting birds, snakes, marsupials, and other wild animals; but after capturing and

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* There appears to still be field for research with respect to the identification of the cattle ticks of Australia.

closely examining a large number, the opinion is formed that either other species of ticks peculiar to these animals have been mistaken for the cattle tick, or the infestation is purely accidental and temporary.

Life History.—The tick's life covers four stages, called metamorphoses—(1) the egg; (2) the larva; (3) the nympha; (4) the adult, or sexually matured form.

When the female tick becomes fully matured, she disattaches herself from her host, and, falling to the ground,* seeks some secluded sheltered spot, such as the foot of tree stumps, beneath logs and dead wood, the crevices in the posts of fencing, &c. Here she remains quiet from two to ten days in summer, or from two to three weeks in winter, after which she commences to lay eggs. At first a few eggs are noticed about the mouth part, forming a small brownish mass, which gradually increases in size until the period of egg-laying has extended over seventeen to twenty-one days. During the process the tick gradually shrinks in size, her body becomes traversed by yellow lines, and on finishing her mission, soon dies. The number of eggs laid varies from 1,500 to 3,000, the average being about 2,000. Immature females also lay eggs, but in much smaller numbers.

The eggs appear as dark, reddish-brown, ovoid, wax-like bodies about $\frac{1}{50}$ of an inch long, and $\frac{1}{80}$ of an inch broad at their widest part. They are very tenacious of life. Moisture has but little influence upon them, consequently the spread of ticks by heavy rains washing the eggs from one pasture to another appears highly probable. Protracted exposure to direct sunlight or to extreme cold destroys their fertility. Still, they are capable of withstanding effect from low temperature to a remarkable degree. For instance, it is reported that eggs laid on the 7th December and placed in an ice-freezer at 15 deg. Fah. for twenty-four hours, and afterwards incubated at 95 deg. Fah., hatched out on 14th January. It would therefore appear that in regions where the temperature is too low for ticks to live upon cattle during mid-winter, they are perpetuated by the resistance of the eggs.

Under favourable conditions, the eggs proceed to develop larvæ or "seed ticks," the time required for which varies from between a fortnight and three weeks to three months or more, depending on external influences such as temperature, moisture, soil, &c. Warm, moist weather, such as that of the north coast, is most conducive to speedy hatching. In appearance the larval ticks have been aptly compared to that of grains of cayenne pepper. They are of a pale-brownish translucent waxy colour, about $\frac{1}{35}$ of an inch in length, and possess but six legs. They are very active during warm weather, when they may be seen hanging, with the front pair of legs spread out, in clusters on the free ends of blades of grass and leaves of low shrubs, weeds, &c. They may also be seen on stumps of trees and posts of fences. From these positions they

* I have observed a mature female tick depositing eggs whilst upon the infested beast.

swarm upon any object that brushes past. This swarming is best observed early in the morning, particularly after a fall of dew, when the faces and legs of stock on badly-infested pastures will be seen to be covered by myriads of "seed ticks." They do not appear to display any discernment as to the object they attach themselves to, as is evidenced by their swarming on inanimate articles, such as one's clothing, blankets, &c. One is at times able to demonstrate the presence of ticks in an unstocked pasture by examining a white handkerchief after trailing it through the grass attached to the lash of a stock-whip. Their parasitism is, however, so perfect, that unless they attach themselves to a suitable host no further development occurs; they soon fall off, and in time perish. Still, they possess great vitality. Schroeder, on 3rd February, 1897, placed some mature female cattle ticks in a glass flask plugged with cotton wool, and kept in a warm room, and by 11th March the eggs had practically all hatched out. These larval ticks, without other food than could be derived from the empty egg-shells and the bodies of the dead adult ticks, and without other water or moisture than could be absorbed from the atmosphere, remained in the flasks until 21st July, or 132 days, when the majority had sufficient vitality to attach themselves to a cow and grow into full-sized adults of the ordinary kind by 13th August, the females subsequently producing fertile eggs. The time that elapsed from the day the adult females were placed in the flasks on 3rd February until a host was found on 21st July, was 168 days, or nearly half a year.

That larval ticks do not like direct sun ray is indicated by the fact that they frequent the shaded side of blades of grass or leaves of trees during the mid-day of summer months. They can, however, tolerate a great degree of cold for a short period. It is recorded that an exposure to a temperature of 16 deg. Fah. for twenty-four hours, followed by incubation at 70 deg. Fah., caused them to appear dead and then revive. An exposure to a lower temperature for twenty-four hours, however, proved fatal. Ordinary rainfall does not destroy them, but flooding does, as they drown on becoming detached and separated.

The larval tick having gained its host, crawls over the skin and finally attaches itself by means of its mouth parts, preferably to places where the skin is soft. It at once commences its parasitic life by obtaining its nourishment from the blood of its host, and if infected will cause fever, although so small as to be difficult to detect with the naked eye. After being on its host for about a week, the six-legged larval tick casts its coat and emerges as the eight-legged nympha. It fastens itself close to the spot where it was previously attached, commences to grow, and becomes of a russet-brown colour, with markings along the back. During the Nymphal stage, the sexual organs develop, and at the second moulting, in about another week, they are complete.

After the second moult the sexually-matured tick reattaches itself on or near its original site. The male and female at this stage are about the same size. They differ from the immature tick, their legs being longer

and the rostrum thicker—there being four pairs of teeth visible on the dart instead of three as in the nympha, and two as in the larva. As they grow, the male and female tick can readily be distinguished. The full-grown male is smaller than the matured female, and has no head-shield. He is about $\frac{1}{8}$ of an inch long, dark brown in colour, having two triangular lobes situated upon the abdomen on each side of the anus. His legs are relatively longer, and he possesses greater activity. The female has a distinct head-shield, and two longitudinal groves upon the back, and three upon the abdomen. She usually becomes fertilized shortly after the second moult, and rapidly increases in size until she becomes fully matured, when she is about $\frac{1}{2}$ an inch long. At first she is a slaty-grey colour with a few irregular yellow markings, but becomes darker, longer, and rounder as she distends herself with blood, a day or two before she drops off her host.

Shortly after the second moult the male tick detaches himself, and seeking a female of the age of puberty, crawls beneath her, reattaches himself to his host so that his abdomen touches that of the female. Fecundation is said to be affected during the night, and that one male tick can fecundate several females.

Engorged females are most numerous on an infested beast at sunrise. As the heat of the day advances they fall off to seek some place suitable to lay their eggs in.

The different periods occupied by the tick in its metamorphosis are subject to variations, depending chiefly upon meteorological influences and environment. The following tabulated statement of the several periods is based upon observations made during the Rockhampton experiment towards the end of 1899:—

Non-parasitic stage—

Period from leaving host to commencing oviposition, about six days.

Period from oviposition to larval stage, fourteen to seventeen days.

Parasitic stage on cattle—

Period from six-legged larva to the eight-legged nympha, about seven days.

Period from nympha to sexually-matured tick, about seven days.

Period occupied by female in maturing, about seven days.

It will be seen the above is within the limits of that given by C. Curtice as the age of one generation, *i.e.*, forty-one to sixty-eight days.

Differs from other ticks.—The cattle tick is frequently confused with others that infest stock, such as bush, scrub, and grass ticks. It is, however, easily differentiated by the characteristics described above, and the pale or whitish colour of the legs of the female.

How ticks are spread.—The lodgment of a single mature female tick upon clean pasture is sufficient, under favourable conditions, to establish a fresh centre of infestation.

The most common manner in which ticks are spread is by matured females dropping from infested travelling stock, particularly cattle.

Fecundated females that develop upon horses, mules, asses, and sheep are capable of establishing new centres of infestation, but do not cause tick fever. Subsequent generations may, however, become infective by gaining access to cattle suffering from that disease.

For a newly-infested pasture to become a fresh centre of infestation, suitable hosts must be accessible and climatic conditions and environment favourable. The permanency of the centre depends upon the constancy of these essential requisites, a fact that explains the sudden disappearance of tick from several inland pastures. Still they may exist sufficiently long to infest other travelling stock, and be carried into places more suitable for their development.

Infested stables and railway waggons are frequently unsuspected sources of infestation.

Almost every living or inanimate object moving on land may act mechanically as agent in the dissemination of larval or seed ticks. On the clothing of man and in the fleece of sheep they may be carried for a day or two, when they seem to recognise the unsuitability of their habitat and drop off to perish unless they subsequently gain a proper host. It is highly probable that those borne mechanically by dogs, marsupials, birds, snakes, &c., are carried but for brief periods and short distances.

Meteorological influences, such as heavy rains and wind-storms, may spread the pest by sweeping tick eggs and vegetation infested by larval ticks from one pasture to another.

Neither the adult ticks nor the young forms are capable of crawling very far.

(*To be continued.*)

Answers to Correspondents.

The following question has been submitted by a fruit-grower in the county of Cumberland:—"I have a patch of Emperor Mandarin trees affected with Red Scale, and I would like to know if, when I have gathered the present crop of fruit from them, it would be injurious to the prospective crop to fumigate previous to blossoming, or would it be preferable to wait till the fruit has grown the size of cherries?"

Mr. Froggatt, Entomologist, in reply, states:—"If you fumigate at night, or during the cool hours of the day, you could fumigate almost at any time without injury to the young wood or blossom. During the past dry season, people have complained that in some instances the ordinary charge of cyanide of potassium has taken off some of the foliage. This is probably due to the long dry spell having weakened the trees through dearth of sap."

Report from the Commercial Agent.

Mr. Valder, Commercial Agent in South Africa, reports that, while the demand for broom millet at present is only a small one, still the broom-making industry is likely to grow, and, therefore, it is advisable suppliers in New South Wales should, if possible, keep in touch with the South African market. Some portion of the supplies reach South Africa from America, and a buyer informed Mr. Valder that with regard to freight, he at one time paid as low as 10s. 6d. per ton measurement, but that lately he has had to pay from 20s. to 25s. for freight from America to South Africa, and as the American millet measures 6 tons for each ton dead weight, this rate works out at £6 to £7 10s. per ton weight. Mr. Valder suggests that if New South Wales millet can be packed in the proportion of 3 to $3\frac{1}{2}$ tons measurement to 1 ton dead weight, a considerable saving will be made, and should bring the price equal to that of the American millet, if not below. The average price for American millet is said to be about £35 per ton c.i.f. Cape Town.

Mr. Valder has forwarded to the Minister for Agriculture the following report on market prices and prospects of trade, under date Cape Town, 22nd June, 1906 :—

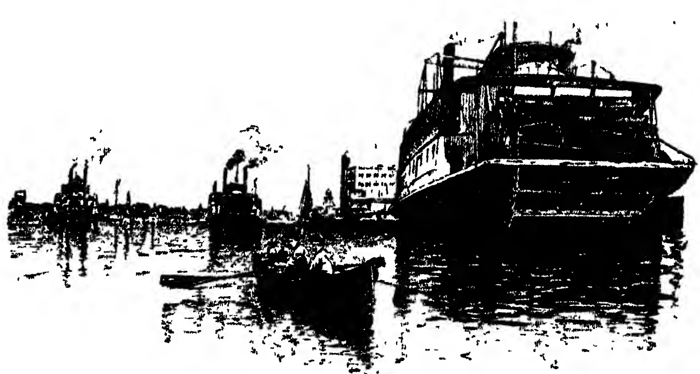
Beef	Australian	3d. to $3\frac{1}{16}$d. per lb., c.i.f.
	Argentina	3d. to $3\frac{1}{8}$d. ,, ,,
	extra hinds	$\frac{1}{2}$d. per lb. extra.
Mutton	Australian wethers, 35–50 lb.	$2\frac{15}{16}$d. to 3d. per lb., c.i.f.
	,, ewes	$2\frac{7}{16}$d. ,, ,,
	Argentina wethers	3d. to $3\frac{1}{4}$d. ,, ,,
Lambs	Australian	$3\frac{3}{16}$d. ,, ,,
Pork	Australian	$4\frac{3}{4}$d. to 5d. ,, ,,
	American	$6\frac{1}{4}$d. ,, ,,
Vealers	Australian, with skins on, 40–100 lb.	$3\frac{1}{4}$d. ,, ,,
	,, ,, 45–80 ,,	$3\frac{5}{8}$d. ,, ,,
Rabbits	Australian per crate,	8s. to 9s , f o.b. Sydney.
Fowls	American	$8\frac{1}{4}$d. per lb., c.i.f.
	Russian	$8\frac{3}{4}$d. ,, ,,
Bacon	Sides	7d. ,, ,,
Butter	Victorian bulk, $11\frac{1}{4}$d. ; pats,	$11\frac{1}{2}$d. ,, ,,
	New Zealand ,, $11\frac{3}{4}$d. ; ,,	1s. $0\frac{1}{4}$d. ,, ,,
Cheese	Victorian	$6\frac{1}{4}$d. ,, ,,
	New Zealand	$6\frac{1}{2}$d ,, ,,
Eggs	Local new-laid	12s. to 14s. per 100.
	Imported	9s. ,,
Wheat	Australian per 100 lb.,	6s. $5\frac{1}{4}$d. to 6s. $5\frac{1}{2}$d., c.i.f.
	S. American Barletta ... ,,	7s. $0\frac{1}{2}$d. ,,
Flour	Australian per ton of 2,000 lb.,	£8 7s. 6d. ,,
	Canadian ,, ,,	£9. ,,
Oats	Algerian per 100 lb.,	8s.
Compressed Fodder	,,	4s.
Potatoes	Local ,,	8s. to 10s. 6d.
Onions	Local per bag of 125 lb.,	3s. to 7s.
Coal	Cardiff steam, per ton of 2,240 lb.,	27s. 6d.
	Hamilton household ,, ,,	24s.

Trade has been exceptionally quiet during this month. This is the result of merchants having previously heavily stocked, in anticipation of increased duties, and to the uncertainty as to whether the new tariff would pass through the various Parliaments. The cold storage companies and other large buyers of frozen produce have also been withholding orders in consequence of the doubt as to whether Australia would receive the ½d. per lb. preference upon meat and butter. The cabled newspaper report regarding the opening of the Commonwealth Parliament contained the following statement:—"That the Government hoped to introduce a Bill dealing with the subject during the present session." It, however, plainly showed that Australia was not likely to come in as a reciprocating Colony for some months to come at least, and, therefore, orders which would have gone to Australia, if we were to receive preference, went to Argentina.

The demand for Australian pork has fallen off considerably, in consequence of several shipments lately received having proved to be of very inferior quality.

The local millers report that the wheat received this season from Australia is the finest white wheat yet placed on this market.

The "Star of New Zealand" arrived this week with, amongst other produce, 4,700 bags of Queensland maize and 7,900 bales of compressed fodder. Unfortunately, both the maize and fodder will be liable to the new duty of 2s. per 100 lb., and this gives little chance of selling at a paying figure. The duty has been increased from 1s. to 2s.



Orchard Notes.

W. J. ALLEN.

September.

At the time of writing, citrus trees are looking anything but well in most of the Cumberland districts, as what with the heavy frosts which have occurred, and the continued dry weather of the last few months, they present a withered appearance. In some of our orange-growing districts there has been as much as 13 degrees of frost, which has had the effect of destroying a large proportion of the summer crop of lemons, as well as causing some of the main crop of oranges and lemons to fall.

Green crops for manuring purposes among the orchard trees have not made much growth in the coastal districts, owing to the dry weather, but at Wagga, where good rains have fallen during the last few months, the crop is doing well.

It is well to make early arrangements for the fighting of the codling moth, and while arsenite of soda has proved to be much superior to the Paris green for fighting this pest, it is now claimed by many in America that arsenate of lead is even better than the arsenite of soda.

First Spraying.—Use 3 lb. of arsenate of lead to 50 gallons of water. The application should be given just as soon as most of the petals have fallen.

Second Spraying.—To follow about three weeks after the first, using 2 lb. of arsenate of lead to 50 gallons of water. Subsequent sprayings may be given at intervals of every four weeks if the moth is bad, using about 1½ lb. of arsenate of lead to 50 gallons of water. This spray is recommended by G. W. H. Valch (*California Fruit-grower*).

In spraying trees with this or any other spray, see that a good pressure is kept up, so that the pump will throw a good fine mist, and be particular to cover the inside and outside of the tree, as well as the whole of the fruit.

It is claimed by some of the Californian fruit-growers that 1 lb. each of lime and sulphur to 4 gallons of water is equally as good if not better than the lime, salt, and sulphur spray, and experiments have proved that the former spray is quite as effective in keeping the San José scale in check, and is much easier to handle. We have tried this spray at our Wagga orchard with every satisfaction; but in order to make it adhere to the trees we boil it for about four hours, using a 200-gallon tank for the purpose. The sulphur should be mixed up like mustard before putting it in the tank preparatory to boiling.

This is a good month in which to plant citrus trees, but is rather late for planting deciduous trees, even during the early part; yet, if they are given special care, such trees and vines may be planted. Cool, cloudy days are the best to select for planting, and the operator must avoid, as far as possible, allowing the roots to become exposed to the sun's rays or the wind. These remarks also apply to planting citrus trees, as where care is taken there should be little, if any, loss among the newly-planted trees. Careless handling is usually responsible for loss, when such occurs.

In most of the drier districts it is best to see that all green crops are turned under this month, in order that they may become well rotted while there is still considerable moisture in the soil. If such crops are allowed to remain in until the land becomes dry, it will be found almost impossible to plough the soil, to say nothing of turning them under, and the chances are that in place of doing good the opposite effect will result, as the moisture, in place of being conserved, will have been taken up by the crop, in consequence of which the soil will have become hardened, and when ploughing is attempted the ground will break apart in lumps, and it will be found impossible to turn the crop under, which will thus dry up instead of rotting as it should. If rain should not fall it will be found almost impossible to bring the land to a proper tilth, and owing to the absence of moisture in the soil, the trees will, in all probability, suffer severely during the summer months, and the fruit will be of little value, as it will be undersized and flavourless.

Therefore, in all dry districts, see that crops intended for turning under as a green manure are not allowed to stand too long before being ploughed under.

In our coastal districts, where rains are of frequent occurrence, there is not the same probability of dry weather overtaking the fruit-grower; consequently he can take more risks than his fellow grower in the interior.

If the spring proves to be a wet one, it is advisable to spray any trees which have in previous wet years shown signs of fungus diseases, such as Peach Curl on the peach-trees, Black Spot or Scab of the apple, Black Spot of the grape-vine; and growers of the Gordo Blanco and Sultana will have to keep a sharp look-out and keep the spray-pumps going, else the crops will be lost.

Bordeaux mixture will be found the best spray at this time of the year for all fungus diseases. Should the San José scale put in an appearance after the leaves have started on the tree, the resin, soda, and fish-oil wash will be found the best to use at this season of the year. Never spray any trees or vines while they are in bloom, else the chances are that the crop will be destroyed. They may be sprayed a week before coming into bloom, and a week after the fruit is set.

Citrus trees may be pruned this month, and there are many orchards which would be greatly benefited by receiving a thorough pruning. Do not allow the lemon-trees to grow high and willowy, but rather remove

those tall, weak limbs which are so often found growing up through the top of all lemon-trees, and keep the tree lower, when it will be found much easier to spray, fumigate, and pick the fruit from it. Oranges and mandarins are generally benefited by a cleaning out from the centre of all superfluous and worthless limbs, twigs, &c.

In every case see that the orchard is in thorough condition in every respect, as the future crop depends so largely on the condition in which the trees and soil are kept during the spring and summer months. See to it, therefore, that no blame can attach to you if they do not make a good start.

Double Disc Cultivator.

Double Disc Cultivator.

This is a large implement, which cuts the ground up deeply if both discs are set at different angles, and it is found particularly useful for running over any crop of green manure just before ploughing them under, as it cuts them up so that no difficulty is found in turning under the heaviest crop after once the implement has passed over them. After running it over an orchard twice, it will be found to cut up all weeds it can reach and leave the land in good tilth. It is, however, a heavy implement to draw, requiring four strong horses when both discs are set at different angles, in which position it does the best work.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

DIRECTIONS FOR THE MONTH OF SEPTEMBER.

Vegetables.

DURING this month, as a rule, warm days set in, and towards the end of it summer may be said to begin; the growth of plants is extremely active, for the soil absorbs a considerable amount of warmth. Should dry weather prevail, vegetables and garden plants are likely to suffer, and unless ample supplies of water can be given for their requirements many may die away. But if the ground has been trenched and well dug and well supplied with animal dung, waste straw, leaves, &c.—that is, plenty of vegetable matter—it may be quite possible to raise vegetables by good cultivation and the use of a thick mulch and any waste water from the house available.

Asparagus.—Plant this at any time during the month; but if the necessary plants are ready and to hand, they had better be set out as soon as possible, and then the planting is over and done with for years.

Bean—French or Kidney.—Sow a row or two twice or three times during the month, in drills about 2 ft. 6 in. or 3 feet apart for the dwarf varieties, and about 4 feet or more apart for the runners. Sow the seeds about 4 inches deep in the rows, and about 5 inches apart. One of the very best of the dwarf-growing varieties is the Canadian Wonder, which has held its own against many new-comers for years.

The following are worth a test:—

"Climbing French Bean—Sutton's Tender and True.—A first-class French bean in every respect, somewhat similar to the above, fleshy and tender. Seed, vermilion in colour.

"Climbing French—Sutton's Earliest of all.—A good type of climbing bean, very early, and a very early bearer. Height, 4 feet. Seed, white.

"Runner Bean—Sutton's Abundance.—A tall runner bean of high merit, a sturdy grower, and a good cropper. The pods are long, fleshy, and tender; 8 to 12 inches in length, and 1 inch in breadth. Stands the heat well, is a fine show variety, and a great acquisition. Seed, white.

"Runner Bean—Sutton's Epicure.—A first-class climber and heavy bearer. Very fleshy pods. Only slightly affected by the extreme heat of the past summer. Very distinct. Seed brown.

"Scarlet Runners—Sutton's A1, Scarlet, Best of All.—Seed, speckled. Are three types of first-class runner beans; have evidently been selected from stock of the highest grade; in fact they are so good that it is almost impossible to say which is the best. They are all heavy bearers, and deserve a place in every garden.

"Runner Bean—Sutton's Tall Sugar.—A good climber; very prolific, and stands the heat well. Seed, white.

"Dwarf French—Sutton's Perfection.—A very early variety, and an enormous bearer. Very fleshy, and of good quality. Seed, speckled.

"Dwarf French—Sutton's Plentiful.—A sturdy grower, and an enormous bearer of good quality. It is almost sure to become a favourite with market growers, and also with private growers whose garden space is limited. This variety and Perfection are two of the heaviest bearers in cultivation. Seed, light brown.

"Dwarf French—Sutton's Monster Negro.—Although not such a heavy bearer as the above, it is one of the very best for private growers, or with those with whom high quality is the main object. It is a very robust grower, and the pods are long, very fleshy, and of excellent flavour. The plants require to be grown from 10 to 12 inches apart. Seed, black.

"Dwarf French—Sutton's Triumph —To all appearances a very good variety. Seed, brown."

Bean, Lima.—Sow in all warm localities, or wherever there are not likely to be any late frosts. A very good variety is King of the Garden.

Beet, Red —Sow seed about 1 inch deep, in drills about 18 inches apart, from time to time during the month. Thin out the seedlings well as soon as they have made two or three leaves. The beets thinned out may be planted in another bed, but they must be taken up carefully.

Beet, Silver.—This is one of the best of vegetables for summer. Sow a little seed in a seed-bed, and transplant when the seedlings are large enough to shift. Not many plants are likely to be required.

Cabbage.—Sow a little seed from time to time, and only sufficient to produce enough plants for small plantings. It is better to plant out small quantities occasionally than a large batch at one time. Make the soil very rich with good, rich, well-made manure—not too rank—and cultivate between the rows frequently. Frequent cultivation will do an immense amount of good to the cabbage, the cauliflower, and all the rest of this class of plants.

Cauliflower.—In the cool districts plant seedlings or plants that have been pricked out, and keep the cauliflowers growing without check from start to finish.

Carrots.—Sow a few rows, in drills, from 1 foot to 18 inches apart; cover the seed very lightly with fine soil.

Celery.—Sow a little seed in box or small seed-bed, and plant out good-sized seedlings which may be ready; manure well, and plant in shallow trenches. It is a waste of time and quite unnecessary to dig out deep trenches for celery, for it can be managed just as well—if not better, certainly much easier—when planted in very shallow trenches, and it is only necessary to make quite shallow trenches to allow of the plants being easily watered, or for the application of liquid manure. Try the best of the self-blanching varieties, and these can be completely blanched with but little trouble.

Choco.—Some vegetable-growers like this vegetable, which grows somewhat like a pumpkin or cucumber, but needs trailing up wire-netting or fence, or some good support to enable it to grow to the best advantage.

Cucumber.—Seed may be sown extensively in all warm localities. Young plants raised for the purpose may be planted out, and they will soon make progress. Manure the soil well before sowing or planting. As the vines extend, pinch the ends, and this will induce growth of laterals.

Endive.—Sow a little seed, and plant out any seedlings that are large enough to handle, just as you would lettuce.

Leek.—Sow a little seed from time to time, and plant out from previous sowings. Sometimes if the weather is very dry leek is difficult to grow during the summer. To obtain the best results it should be grown without a check by using abundance of water and a good deal of liquid manure.

Melons, Rock and Water.—Sow seed in all warm localities as extensively as may be required.

Okra.—Sow a little seed in warm places, and afterwards transplant the seedlings to well-manured ground. They should stand about 2 feet apart. This plant is sometimes made use of for ornamental purposes in the flower garden, for it is very pretty when in full bloom

Onion.—Be sure to grow some onions, for they are very useful indeed, and if good keeping kinds, such as the Brown Spanish, be grown, a supply can be kept for a considerable time in the house. If onions have already been raised in a seed-bed they should be transplanted without delay. The soil should be made rich and the surface fine where seed is to be sown.

Parsnip.—Sow a few seeds in well-dug land. The digging, or trenching, which would be better, should be deep, for the parsnip is a deep-rooting plant, and needs the soil to be well worked, especially if the soil below the surface is at all stiff.

Peas.—Sow a row or two from time to time during the month.

Pepper or *Capsicum.*—Sow seeds in a warm spot and plant out seedlings when large enough. If plants have already been raised, plant out in all warm localities. Probably one or two plants will suffice for a family.

Potato.—Plant extensively of this useful vegetable. Select clean, smooth seed, and try several varieties to test their suitability for the climate, soil, and situation. Manure freely, plant about 5 or 6 inches deep, and cultivate the land frequently between the potatoes as soon as they appear above the ground. They should be planted from 2 ft. 6 in. to 3 feet or even more apart if the ground is very rich.

Pumpkin.—Sow a few seeds in well-manured land. Do not manure in holes, but spread and dig in the manure all over the space where the pumpkins are to grow.

Rhubarb.—Plant out early in the month and obtain some of the winter varieties in addition to the summer kinds. If plants for future use are

likely to be required, sow a little seed, and in a year or two these should be quite large enough for planting out.

Tomato.—Sow seed in the open ground in all the warm districts of the State. Already in the warmest parts tomatoes are growing satisfactorily, and will soon be producing flowers and fruit. At the Wollongbar Experimental Farm, Richmond River, the gardener, Mr. King, tested several varieties of tomatoes for me. He found Dwarf Champion to be an excellent one, and well worth growing. The older and well-known Matchless he found to be wonderfully good in the district, as it seems to be in other places. This tomato Mr. King considers to be one of the best to grow. For his tomatoes he applies liquid manure three times a week—twice with sulphate of potash, half ounce to the gallon of water, and once with nitrate of soda, one ounce to the gallon of water.

Turnip.—Sow a few seeds from time to time.

Vegetable Marrow.—Sow in same way as advised for pumpkin

Flowers.

The garden should be bright with flowers of a great many varieties during this and succeeding months, should the weather prove at all favourable

Seeds of tender annuals should be sown almost everywhere. Of these the balsam is one of the prettiest, if well grown. It needs abundance of manure and a good deal of moisture to enable it to grow to perfection. The zinnia will be found a useful annual, and the single varieties of dahlias treated as annuals will make a remarkable display if grown in clumps and are well manured. Seeds sown now will produce plants which will flower in the early summer or early autumn.

Bouvardias may be planted out, and as they are most useful and beautiful plants when in flower, they should be grown everywhere.

Plant out pelargoniums, for they are also useful and beautiful plants

Petunias will make a fine show during the summer if seed be sown at the present time.

Farm Notes.

Hawkesbury District—September.

H. W. POTTS.

Again we are face to face with actual droughty conditions,—hay-sheds are in many cases empty, lucerne paddocks bare, and the autumn-sown crops languishing. Even if rain should fall at once, there must inevitably be a shortage of hay, and the problem that confronts the farmer is the necessity of providing feed during the early months. The general scarcity is felt very acutely on all sides, and every day the situation becomes more apprehensive. Under such circumstances, it is absolutely essential to plant early, and to choose crops capable of producing green feed within the shortest time. So far, we know of nothing better for this purpose than the millets, of which Hungarian and French have both proved satisfactory here. Green feed, under ordinary conditions, may thus be obtained in six or seven weeks, and hay a month later. They should be sown on land which has been well ploughed and reduced to a fine tilth (as the seed is rather small), at the rate of 7 to 10 lb. per acre, and lightly harrowed in. Thus, at a cost of about 2s. 6d. per acre for seed, a highly nutritious, quick-growing crop is obtainable. In the unlikely event of the millet not being required for green feed purposes, the seed has a definite value for poultry, and is keenly relished by them. No farmer should, therefore, hesitate to put in at least a few acres.

Potatoes.—The prospect for this crop is by no means encouraging. With a dry surface soil, and no under reserve of moisture, planting becomes exceedingly risky. Seed runs to £12 and £13 per ton, and the sample even at that figure cannot be said to be good. It behoves everyone who decides to plant to give the land the greatest possible attention, and 2 acres of well-treated tubers will yield a far greater net return than double the area carelessly dealt with. Potatoes are gross feeders, and well repay rich manuring. Wherever farm-yard manure is obtainable, it should be used with no unsparing hand; but it is usually necessary to apply commercial fertilisers, in which potash must be the dominant factor.

If already planted, a top dressing of 2 cwt. of a soluble mixture may be given just before or after rain, and well incorporated in the soil by means of a Planet Junior. Should, however, planting not have taken place, attention should be given to the choice of a suitable variety which is known to have done well in the neighbourhood. With us, Brownell's Beauty has given the best results, followed by Early Rose and Bliss's Triumph.

Every farmer should, however, try a small patch of some one or more of the less-known kinds, such as Breese's Prolific, Manhattan, Early Red Ruby, Northern Star, Up-to-date, Early Northern, Beauty of Hebron, &c., to ascertain their suitability for his class of soil. In any case, the sets should be steeped in a solution of corrosive sublimate, to check the scab which infests so much of the seed now on the market. Should dry conditions continue to prevail, the soil must be kept constantly stirred to check evaporation and prevent weed growth.

Maize.—This, the staple crop of the Hawkesbury lowlands, usually receives its full meed of attention. The absence of rain during the winter has enabled the farmer to get his land into first-class condition for planting at the earliest opportunity. Few have yet seen the desirability of cutting the cornstalks into short lengths and ploughing them in, and the old method of raking and burning still holds good.

For green feed and ensilage purposes, care should be taken to select varieties which mature early and provide a heavy yield of leaf and stalk. One of the earliest maturers is Ninety Day, which is fit to cut well within four months, but the pride of place which it held so long bids fair to be taken by Hickory King, Early Mastodon, Hawkesbury Champion, Iowa Silver Mine, &c. For this purpose, drills may be struck out 3 feet apart, and a single seed sown by hand or by a corn-dropper every 12 inches in the row. Under favourable conditions, a yield of 12 to 20 tons per acre may be expected. If the use of fertilisers is deemed necessary, nitrogen should predominate to promote a healthy and vigorous leaf growth.

For grain, different methods must be adopted. The customary width between the rows is 4 ft. 6 in., and when dropped by hand three or four grains are sown about 4 feet apart in the rows. Machines are used to drop in a similar way, but experience here rather favours the sowing of a single grain every 16 or 18 inches. The Hawkesbury district has little to learn with regard to its main crop of maize, and though perhaps the original names of the various kinds have been lost, the sample produced, for weight per bushel, yield per acre, and general quality, would be hard to excel.

For the poorer and shallower highlands, the quicker-maturing varieties are more suitable than the main croppers, and among these Pride of the North, Riley's Favourite, Improved Early Mastodon, Early Red Hogan and Abercrombie among the reds, and Hickory King and Iowa Silver Mine among the whites, should be largely used.

Experience in manuring maize for grain points to the advisability of applying half the necessary quantity at or before planting, and the balance as a top-dressing when the crop is about 2 feet high, just about hilling time and before the last cultivation. If the full quantity is applied at the outset, it tends to produce a tall, sappy growth, and thus renders the crop less able to withstand the check produced by the fierce westerlies, so common in December and January.

Sorghum.—The crop which stands next to maize as the most suitable producer of bulky feed for stock is sorghum, and it has the advantage over maize in that it can be cut twice and even thrice in a season. Further, although growth is stopped by frost, it may be left standing in the field far into winter, and is even then keenly relished by stock. It is customary locally to broadcast a patch or two in any odd corner, often in a headland; but it deserves rather better treatment, and well repays attention. Sown in drills 3 feet apart, at the rate of 6 to 10 lb. per acre (the smaller quantity on the richer land), it is capable of yielding up to 20 and even more tons per acre of rich succulent fodder for horses, cattle, sheep, and pigs. Early Amber Cane and Planter's Friend have both done well here, and the former if sown now will, with favourable weather conditions, be fit to cut before Christmas. It can then be well cultivated with a Planet Junior, and in a couple of months would have a smaller, but nevertheless valuable, supply of stalks. The seed is also suitable for poultry, but in this district the birds have a particular fancy for it, and little is left for the farmer.

Attention might with advantage be given to experimenting with a mixture of sorghum and cowpea, as it has been found to be a highly nutritious and well-balanced ration. If sown with a dropper, the seed should be dealt with separately, putting in the sorghum at the usual rate, and then sowing a single seed of cowpea about every 12 inches. It will be found that the latter will climb up the sorghum stalks and produce a wealth of foliage with few pods. In this district, Black cowpea has been known to grow 9 feet up a sorghum stalk, and in plenty of instances was over 6 feet.

Cowpea.—Though this crop is yearly becoming more recognised both as a fodder and as a soil-renovator, it does not yet occupy the place in the rotation which its merit deserves. On all light soils, when ploughed in or fed off, it is a valuable agent in increasing nitrogen and adding humus. Where labour is plentiful and cheap, it is well worth growing for seed, which usually fetches from 10s. to 12s. 6d. per bushel, according to the variety, and the tops can be ploughed in or made into nutritious hay. The seed, especially that of the White variety, has a high value as a vegetable, and more than one settler regularly uses it in place of the haricot bean. The trailing varieties which up to the present have been most commonly grown are the Black, Whip-poor-Will, Clay-coloured, and White, but the introduction of upright, easily-harvested strains which are still being experimented with here and at the different Government farms, will go a long way to still further popularise this valuable plant.

Pumpkins, Melons, and Squashes.—These should be sown as early as practicable, even though the chance of frost may not be over. Water-melons must be early to secure the best market returns, and everything should be done to promote growth and to prevent any check from the outset. Pumpkins, in particular, well repay manuring; and the highest

prices secured last season for pumpkins grown on a large scale were obtained by a local farmer who applied judicious, but ample, quantities of fertiliser. When manure is applied at time of sowing, care should be taken to incorporate it well with the soil, to prevent the delicate germinating seed from coming into contact with it.

Mangolds and Sugar Beet.—Few of our farmers have yet realised the value of these crops as feed for their stock, and every dairyman and pig-breeder should grow an acre or two. The ground should, wherever possible, be deep and rich, and ample supplies of manure furnish an adequate return on the outlay. The Mammoth Long Red Mangold gives the best result on the deep loams, while the Yellow Globe has proved the most satisfactory on the shallower and lighter soils.

Artichokes.—For any odd corner of the farm which is not likely to be needed for general cultivation, nothing could be better than to plant artichokes. An old pig-run is particularly suitable, especially one that is only used for a month or two in winter, whilst topping-up candidates for the bacon-room. Early plantings may now be made. Pigs eat them with avidity, and when off-colour soon regain healthy digestive functions. Artichokes are also eminently suitable for sows after suckling a litter, as they act as a tonic and diuretic. As they are somewhat difficult to eradicate, they should not be planted as a general farm crop.

GLEN INNES DISTRICT—SEPTEMBER.

R. H. GENNYS.

OATS may still be sown in this district for hay. Sow thickly, as this will bring the crop in earlier and also produce hay of finer quality than if sown too thinly.

Potatoes.—May be sown at the end of the month, but should be planted sparingly, as there will still be danger of late frosts. The rich red loams are the best for this crop, and the climate of the district is all that can be desired. The heavy soils, however, are not suitable for tubers, as they are apt to contract and crack in dry weather, and at other times are too moist. *Liming* and *draining* will, however, much improve them, not only for growing potatoes, but for other crops also.

Vegetables.—Sow peas, cabbages, cauliflowers, lettuces, celery, radishes, carrots, and parsnips, and keep land in condition for other spring crops.

If the wheat crops are suffering from dry weather, harrow them to conserve moisture.

Grasses and Clovers.

Artificial Grasses.—Land should have a first ploughing some time before sowing with grasses. If ploughed early in the winter, a fair depth in ploughing should be practised, but prior to sowing in the spring—say, 14th of September—there should be another ploughing of a more shallow description, merely working the surface 2 or 3 inches, as the subsoil

should be firm for all grass roots. The cultivation, though shallow, should be thorough, breaking down all lumps, and bringing the soil into a very fine tilth, as, if not, much seed will never produce plants that will reach the surface, even if they germinate. After a shallow ploughing the cultivator should be freely used—the Double Disc (see Orchard Notes, this month) for preference—then a light harrow; if not fine enough then, roll and sow immediately after. After sowing, a very light covering is what is required, say, half an inch of fine earth. If a very light harrow is not procurable, use a brush-harrow; better not cover at all than too deeply. Do not sow when the soil is very wet, or it will be impossible to cover seed evenly. If sowing clover by hand on the same land as grasses, sow the grass-seed first, as it is much lighter than the clover-seed, and if sown together an uneven distribution is likely.

Perennial Rye Grass.—The seed-head of this plant consists of a central stem or axis, with the spikelets on either side of it. The leaves are dark-green colour, ribbed on the upper surface, shining and smooth on the back. Perennial Rye Grass grows well under most conditions, more especially in medium and heavy soil, but must have plenty of moisture, otherwise it quickly dies out. In no case should this grass be allowed to go to seed the first year, but should be fed lightly with cattle or sheep, in order that it may stool properly. If treated well, it produces a good bottom of grass, and is of fair feeding value.

Italian Rye Grass is an annual or a biennial, and is therefore only suitable for temporary pastures. It is very similar in appearance to Perennial Rye Grass. It grows tufty and is on a larger scale. The seed is similar, except that the spikelets are awned, the colour of the plant lighter, and the stem more flattened. It will grow on most soil, preferring rather moist loams. It appears to be, from experience here, a much better drought-resister than Perennial Rye. If kept eaten down will last a considerable time, and may almost be termed a perennial.

Timothy or Meadow Cat's-tail (*Phleum pratense*) has a flower-head of a cylindrical form of a bristling character, the ends of glumes being furnished with short stiff bristles, spikelets almost at right-angles to central stem. Leaves are of a light-green shade, and in dry seasons may have slightly bluish tint. Leaves rise obliquely into the air, and do not curl over like some blades of other grasses. The seed is rather heavy, and of a light-silvery colour. This colour in the seed is important, as if dark it is not nearly so good. Timothy does well on heavy clays, and should flourish in New England. If cut early it makes capital hay, but if left too long gets very wiry.

Cocksfoot (*Dactylis glomerata*) is a useful, hardy grass, but not very fattening. The seed-head is branching, the spikelets being set in dense masses at the ends of the branches. The stem is rather rough and coarse. The leaf is somewhat thin, smooth, and rather dull-looking. The ligule is large and jagged at the point. Seed whitish in colour, much keeled at the back. Suits soils of a medium heavy and moist character, but it

also does well on drier and poorer soils. In its earlier growth it is nutritious and much relished by stock, but as it matures it becomes coarse and woody. In sowing mixed pastures on rich land, if sown at all, use only small proportions, as it is liable to choke out other grasses. It should be kept grazed. It is one of the best winter grasses, and suitable for the tablelands of the State. It succeeds better than most grasses under the shade of trees. It is known in some countries as Orchard Grass, as it is often grown in orchards and gardens.

Kentucky Blue Grass (*Poa pretensis*) is a splendid pasture grass, and is a fine stooler. It is a perennial and spreads rapidly by seeding and by suckers or runners, forming a close and compact covering on the soil, stands trampling and eating down well; also withstands dry weather better than most, and does well on clayey loams, which it prefers to sandy soils. Rather slow to take possession of soil, but when it does is difficult to get rid of. It is also a good lawn grass, and its compact nature makes it very suitable for turfing.

Prairie Grass is too well known to need a lengthy description. It is rich, succulent, a splendid winter grass—perhaps the best we have—and for milking cows is excellent. It does not stand dry, hot weather well. Stock are apt to eat it too close to the ground, and it dies out quickly under much treading. It should be lightly stocked and allowed to seed occasionally, when it may last some time. In a garden where it is not eaten down it grows luxuriantly, and often kills out other grasses.

Prairie Grass makes excellent hay, and is easily saved. It is not always free from the ravages of *smut*, which also attacks other grasses.

Pasture Plants.

Red Clover (*Trifolium pratense*) is an excellent fodder plant, with broad leaves, and has a purplish-red flower. Under favourable conditions, it will last several years. It also makes excellent hay, and being a leguminous plant enriches the soil wherein it is planted. In pastures it also helps the shallow-rooted grasses by bringing up nitrogen from the subsoil through its deep roots, and also by fixing nitrogen obtained from the air. It has done well here, and should be suitable for all the tablelands of the State.

Bathurst District—September.

R. W. PEACOCK.

In this district September generally may be regarded as the first month of spring. Frosts are usually persistent throughout the month, and are apt to recur until the middle of October, especially upon the lower levels. Upon the uplands the season is fully a fortnight earlier, and this should be borne in mind when the planting of plants which are liable to be frosted is under consideration.

Potatoes can be planted largely about the middle of the month for the early crop, as such would not appear above ground for three or four weeks after planting. Where frosts are not severe, they may be planted somewhat earlier. Early Rose and Brownell's Beauty are suitable standard varieties.

Maize may be sown upon the uplands during the last week. Golden Beauty, Riley's Favourite, Hickory King, and Iowa Silver-mine are very suitable for the district.

Jerusalem Artichokes may be planted towards the end of month. They are very suitable for winter pig-feed.

Mangolds and Field Carrots should be sown largely. They are excellent for stock throughout the winter, and are available when other fodders are scarce.

Wheats.—The rolling and harrowing of the wheat crops should be completed as soon as possible; the harrows should always follow the roller in order to form a loose soil-mulch to conserve moisture.

Vegetables.—Sow for main crops, parsnips, carrots, beet, and cabbage. Sow lettuce, peas, radishes, white turnips, cress and mustard.

The planting out of asparagus and rhubarb roots should be completed early in the month.

Clarence River District—September.

T. WALDEN HANMER.

We have experienced again this winter a very dry time, although it has not been as frosty as last year, and we had rain a little later, but all engaged on the land are anxiously looking for rain at the time of writing these notes, for grass—and, in many instances, water, especially for household use—is getting very scarce. In consequence of this dry season, planting operations are again behind.

Potatoes.—We were very lucky to strike a few hundredweight of imported English Early Rose and Northern Star seed-potatoes in time for planting for winter crop. They yielded very well considering the sea trip that they came through, and the change in climate and soils. We have replanted a large area with some of them for the summer crop. We are also growing Bliss's Triumph, Brownell's Beauty, Satisfaction, and have a few rows of Beauty of Hebron, Dear Early, Freeman Late, and Manhattan. Any seed-potatoes on hand should be planted out with as little delay as possible, as it is getting late for this district. There seems to be a larger area planted already than usual; many were planting in the middle of July, but they run a risk of being a failure with the possibility of many late frosts.

Lucerne.—This very valuable fodder-plant may be sown this month, provided, of course, that there is enough moisture, and the land thoroughly well tilled.

A few dry seasons should have pointed out to all farmers what a tremendous benefit a patch of lucerne is. As hay it can always be kept, as there is no trouble with mice, there being no seed ears to attract them, as is the case with hay made from wheat, oats, &c.

Maize.—This might be considered the crop of the Clarence. We think all the same that by far too little attention is paid by growers to the quality of the seed planted, and they are rather too apt to reckon it a good crop that has a very tall, thick stalk with one cob, whereas a shorter stalk and at least two cobs on it would be the more profitable, and seed saved from that which throws out at least two medium-sized cobs well developed. Of course, the size of core and depth of grain must not by any means be overlooked.

There appears to be a great deal of prejudice against white corn, that seems hard to understand.

Onions.—Growers of this favourite bulb will find plenty of work this month thinning-out and weeding; they usually command good payable prices, however.

Melons (Water).—Cuban Queen, Fordhook Early, and Kleckley Sweet are of the finest varieties grown, and are usually much appreciated during the hot months.

Melons (Rock).—Kirkgegatch, Cassabah Long, Altum Bash, Golden Perfection, and Early Hackensack are excellent.

Pumpkins and Squashes.—True Ironbark, Button, and Crown are good for table use, and Anderson's Mammoth for stock feeding. Moore's Cream, Long White Bush, Delicate, Custard, and Essex Hybrid will be found very good eating squashes.

Ladybirds usually play havoc with the young melon and pumpkin vines. Dusting with fine ashes or lime when the dew is on the leaves will usually effectively stop their ravages, although, perhaps, this is rather a big undertaking where acres of them are grown.

Sorghum.—This month is a good one to sow sorghum, and the best varieties are Amber Cane and Planter's Friend. Some people prefer this in drills, but we find that if simply thrown out to the cows in the paddock to eat, they prefer it when the stalk is fine as it grows if broadcasted, whereas when drilled in the stalk usually grows coarser, and then, if thrown out in the paddock, the cows often only eat the leaves and tassel, and the stalk becomes wasted. Where it is possible to chaff it all up, hardly a speck of it will be left by the cattle.

Riverina District—September.

G. M. McKEOWN.

Potatoes.—Planting should be completed as early as possible, the earliest varieties only being selected. Flat cultivation will be found to answer best, so as to admit of the necessary after cultivation, which cannot be properly carried out where the rows are hilled high without injury to the crop. Enough soil only should be thrown up to protect the upper tubers from the heat.

Pumpkins and Squashes.—Sow, as soon as danger of frost is passed, on a site as free as possible from this risk. Early plants are frequently killed by late frosts, and fruit which sets late is prevented from maturing by the occurrence of early autumn frosts. The land should be deeply worked, brought into fine tilth, and well manured. The seed should not be sown in raised mounds, but "on the flat," the portions sown being well mulched with stable-manure. King of the Mammoths and Mammoth Tours are to be preferred for field culture. For table use the following will give good results and be found of excellent quality, viz., Early Orange Sugar Pumpkin, Delicata, Fordhook and Custard Squashes, and Long Green and Long White Bush Marrows.

Melons should be sown towards the end of the month in well-prepared land which has been thoroughly pulverised and well manured. The young plants should be protected in localities where there is risk of damage by frost. The following varieties will be found among the best, viz., Dixie, Kleckley Sweet, Wonderful Sugar, and Cuban Queen. Of rock melons, sow Golden Perfection, Pineapple, Hackensack, and Montreal. Cattle melons should also be sown.

Sorghum.—Sow in deep alluvial soil which has been well tilled. The best varieties are Black or Saccharatum and Amber Cane. Seed should be sown in drills 3 feet apart. Ten pounds of seed will be sufficient for an acre.

Vegetables.—Where water is plentiful, sow towards the end of the month, beans of dwarf and running varieties in situations sheltered from hot winds where water is available. Transplant cabbages and cauliflowers into well-manured land, placing the plants about 2 feet apart in the rows, which should be 3 feet apart to admit of cultivation. Mulch and water freely. Sow tomatoes, and transplant any which may be available from previous sowings.

Shelter from frost should be provided.

Crown Lands of New South Wales

The following areas will be available for selection on and after the dates mentioned:—

For Conditional Purchase Lease—(Crown Lands Amendment Act of 1905).

C.P.L. No.	Name of Land District	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
			Dorrigo Lands.				
		acres.		acres.		£ s. d.	1906.
26	Bellingen	31,651½	129	134 to 457½	The subdivision is distant 9 to 20 miles from Coramba; 20 to 40 miles from Coff's Harbour; 20 to 31 miles from Bellingen; 70 miles from Grafton; 70 miles from Armidale; and 5 to 9 miles from village of Dorrigo.	5 8 6 to 17 3 2	20 Sept.

The subdivision is situated in the parishes of Ucombe, Stewart, Comlaroi, Gundar, Allan, Leigh, and Bligh, county of Fitzroy. The better portions of the area comprise considerable extent of rich basaltic soils, heavily timbered with soft woods, found in dense brushes, and including among many minor varieties, red bean, pine, a little cedar, crab-apple, black-apple, rosewood, marble-wood, stinging-nettle tree, prickly ash (or scrub silky-oak), carrabean, sassafras, white and brown beeches, cherrywood, negro-head beech, &c.; the remainder of the land consists of undulating and steep, high, broken range country, with hardwoods such as blackbutt, mahogany, tallow-wood, gum, leather-jacket, &c., and here the soil is mainly slate formation; suitable for agriculture, dairying, orcharding, and mixed farming, when cleared.

23	Bingara .	2,625	10	137 to 425	Bingara, 2 to 3½ miles	8 8 10 to 19 18 0	6 Sept.

Undulating open forest country to broken country with low hills; mostly slate and quartz formation, strong in places: chiefly red soil, gravelly, with clay subsoil; timbered principally with box and ironbark, with some pine, apple, and yellow-jacket; good grazing land, the present carrying capacity of about one sheep to 1 acre, or one head of large stock to 6 acres, and of the other half of the area, one sheep to 1½ acres, or one head of large stock to 8 acres; part suitable for cultivation; permanent water in Hall's Creek.

25	Deniliquin ..	3,049	14	190 to 264	Deniliquin, 2¾ to 5½ miles.	11 1 8 to 17 12 10	13 Sept.

Flat country; chiefly red, brown, grey, and black soil, crab-holey in places; mostly plain country, parts moderately thick forest, and open forest, timbered with gray box (mostly ringbarked), yellow box, pine, and oak; parts would probably grow wheat and hay in good seasons; no permanent water, but soil is retentive, and catchment good.

24	Grenfell ..	....	1	308½	Grenfell, 10 miles ..	9 12 8	20 Sept.

Nearly level land; timbered with gum, box, and pine; red loamy soil, generally good agricultural land; no natural water supply.

For Original Homestead Selection only.

H.S. No	Name of Land District	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date Available.
			acres.			1906.
999	Bathurst ...	1	690	Bathurst, about 12½ miles	£7 3s. 10d.	13 Sept.

Hilly and mountainous country: mostly pastoral; small patches fit for hay crops; no permanent water.

For Original Settlement Lease only

S.L. No.	Name of Land District.	Holding, &c.	No. of Farms.	Area of Farms.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
				acres.			1906
838	Condobolin ...	Euglo .	1	4,750	Condobolin, about 29 miles.	£69 5s. 6d. ...	11 Oct.

Almost level country, with some gilgai holes on eastern part; about 1,000 acres consist of red sandy loam, and the remainder is red clayey soil; about 1,750 acres plain, remainder forest of box, pine, belar, boree, yarran, buddah, and gum, of which about 250 acres are covered with scrub of belar and box seedlings and warrior bush; about 1,200 acres suitable for agriculture. Rainfall, about 17½ inches per annum. Ms. 1906-10,991. Humbug Creek intersects the farm and affords a temporary water supply. Existing tank affords sufficient supply

FOR ORIGINAL CONDITIONAL PURCHASE ONLY—(Classified under Subsection 1A, Section 4, of Crown Lands Amendment Act, 1905).

Name of Land District.	Name of Holding, &c.	Parish.	County.	Total Area.	Price per Acre.	Date available.
				acres.	£ s. d.	1906.
Carcoar	....	Thompson	Georgiana ..	130	0 15 0	27 Sept.
Rough, broken country, suitable for grazing only.						
Gunnedah* ..	Piallaway and Wallhallow (partly).	Wallala	Buckland ..	212½	3 0 0	11 Oct.
Being portions 131 and 132, suitable for grazing.						
Nowra	....	Wallaya .	Camden ..	67¼	1 0 0	27 Sept.
Being portion 295, suitable for grazing, and a small portion for cultivation.						
Singleton ..	.. ...	Werong .. .	Northumberland.	80	1 0 0	6 Sept.
Being portions 8 and 9, suitable for grazing and cultivation.						
Singleton .	.. . . .	Cosgrove	Northumberland.	80	1 0 0	6 Sept.
Being portions 25 and 115, suitable for grazing and cultivation.						
Tamworth* ..	Tamworth Population Area.	Woolomol, Moonbi, and Tamworth.	Inglis .	4,523¼	2 0 0 to 3 0 0	20 Sept.
Rough and hilly grazing land, with small patches for mixed farming.						

* Identical with special area (see below).

FOR ORIGINAL CONDITIONAL PURCHASE AND CONDITIONAL LEASE IN VIRTUE THEREOF—(Classified under Subsection 1b, Section 4, of Crown Lands Amendment Act, 1905).

Name of Land District.	Name of Holding, &c.	Parish.	County	Total Area.	Price per Acre.	Date available.
				a. r. p.	£ s. d.	1906.
Albury	....	Mountain Creek	Goulburn .	496 0 0	2 10 0	18 Oct.
Good grazing and agricultural land.						
Bathurst	....	Oberon . ..	Westmoreland.	800 0 0	0 13 4	18 Oct.
Suitable for grazing.						
Murrurundi	Mooki Springs Holding (partly).	Telford	Buckland ..	490 0 0	2 10 0	11 Oct.
Grazing land, part suitable for cultivation.						
Parkes	Coradgery Holding	Limestone	Kennedy ..	355 0 0	1 5 0	11 Oct.
Suitable for grazing and agriculture.						
Tamworth	....	Welsh .. .	Darling ..	550 0 0	0 8 4	18 Oct.
Suitable for grazing.						
Tumut	Red Hill Holding.	Adjungbilly and Wyangle.	Buccleuch ..	1,080 0 0 (in 2 areas of 540 acres each).	0 15 0	11 Oct.
Good grazing land, small patches suitable for cultivation, fruit-growing, &c.						
Wyalong	....	Mulga	Gipps ..	1,350 0 0	0 15 0	6 Sep.
Do	....	do	do .	1,000 0 0	0 13 4	,,
Grazing land, parts suitable for agriculture.						
Young	Moonbucca and Milong Holdings.	Weedallion	Bland ..	460 0 0	1 15 0	18 Oct.
Suitable for grazing and agriculture.						

CONDITIONAL PURCHASE (ORIGINAL OR ADDITIONAL) OR CONDITIONAL LEASE (available by revocation of reserves, and not classified or specially set apart under section 4 of the Crown Lands Amendment Act of 1905).

Name of Land District.	Name of Holding, &c.	Parish.	County.	Total Area.	Price per Acre.	Date available.
				a. r. p.	£ s. d.	1906.
Muswellbrook ..	....	Worondi	Brisbane	90 0 0	1 0 0	27 Sept.

Grazing land, suitable in parts for cultivation.

CONDITIONAL PURCHASE AS SPECIAL AREA.

Tamworth Land District, within Tamworth population area, 4,523¼ acres, in 29 blocks, in parishes of Woolomol, Moonbi, and Tamworth, county of Inglis, maximum area 320 acres, minimum area 40 acres, grazing land suitable for residential areas with small patches for mixed farming; prices range from £2 to £8 per acre. Available for original applications only on 20th September, 1906.

Gunnedah Land District, on Piallaway and Walhollow holdings, 212½ acres, being portions 131 and 132, parish of Wallala, county of Buckland, maximum area 212½ acres. minimum area 42½ acres, suitable for grazing; price £3 per acre. Available for original applications only on 11th October, 1906.

FOR IMPROVEMENT LEASE.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Upset Annual Rental per Block.	Date of Sale or Tender.
	CENTRAL DIVISION.						
			acres.		acres.	£ s. d.	1906.
1368, 1369, and 1370	Narrandera	Kerarbury	1,760	3	460 to 685	5 15 0 to 8 11 3	Tender. 10 Sept.

Level country, small part open plain; red clay soil; timbered with pine, box, yarran, and boree. Water can be obtained in wells at a depth of 100 to 120 feet. Rabbits exist.

1371 and 1372	Narrandera .	Tubbo	2,159¾	2	1,199¾ & 960	22 10 3 and 20 0 0	Tender. 10 Sept.

Level country, small part open plain; red and gray clay soil; timbered with pine, box, boree, wilga, and some needlewood. Water can be obtained in wells at a depth of 100 to 120 feet. Rabbits exist. The blocks are situated from 8 to 10 miles south from village of Waddi, about 20 miles southerly from Darlington Railway Station, and about 45 miles south-westerly from Narrandera Railway Station.

1421 and 1422	Narrandera .. .	Tubbo	877½	2	327½ and 550	8 3 9 and 13 15 0	Tender. 10 Sept.

Practically flat country; clay loam soil, small part sandhills; timbered with gum and box (and pine with some pine scrub on block 1,422). Liable to inundation. Permanent water in the Murrumbidgee River. Average annual rainfall, about 15½ inches Rabbits numerous on sandhills. Situated about 10 miles south-westerly from Whitton Railway Station.

1423 to 1429	Parkes	Kerriwah	22,229	7	2,319 to 3,760	16 16 5 to 21 0 0	Tender. 17 Sept.

Generally almost level country; on blocks 1,423, 1,424, 1,425, and 1,429 there are in all about 680 acres of stony gravelly ridges, and on blocks 1,424, 1,425, and 1,427 there are patches of gilgai country amounting to about 730 acres; thickly timbered with pine, box, oak, belar gum, and yarran, with some ironbark on the ridges. Almost the whole of this country is covered with scrub of the varieties above-mentioned, with some emu-bush, cherry, currant-bush, warrior, wilga, quandong, hop, wattle, budda, blue-bush, gooma, heather, dogwood, mallee, currawang, and sifting-bush. Soil is generally a red sandy loam, mixed in places with a little quartz gravel; about 4,000 acres of the whole area consists of a fairly hard good red clay. Bulbodney Creek affords temporary water supply to blocks 1,424, 1,425, 1,426, and 1,427; dam of 2,800 cubic yards affords a good supply on block 1,423; good sites for tanks and dams on all the blocks. Rainfall, about 20 inches per annum. Dingoes are very troublesome, and rabbits are rapidly increasing. The blocks are situated about 17 to 27 miles southerly from village of Dandaloo, about 46 to 56 miles south-westerly from Trangie Railway Station, and about 50 miles northerly from Condobolin Railway Station.

AGRICULTURAL SOCIETIES' SHOWS.

1906.

Society.	Secretary.	Date.
Yass P. and A. Society ...	W. Thomson	Sept. 4, 5
Henty P. and A. Society	P. H. Pacch	,, 4, 5
Manildra P. and A. Association	E. J. Allen	,, 5
Junee P., A., and I. Association	T. C. Humphrys	,, 5, 6
Grenfell P., A., and H. Association	Geo. Cousins	,, 6, 7
Albury and Border P., A., and H. Society	W. J. Johnson	,, 11, 12, 13
Young P. and A. Association	Geo. S. Whiteman	,, 12, 13, 14
Wyalong District P., A., and H. Association	S. G. Isaacs	,, 18, 19
Berrigan A. and H. Society	G. Hamilton	,, 19
Germanton P., A., and A. Society	Jas. S. Stewart	,, 19, 20
Cowra P., A., and H. Association	F. A. Field	,, 19, 20
Temora P., A., H., and I. Association	W. H. Tubman	,, 25, 26
Gunnedah Show	J. H. King	,, 25, 26, 27
Lockhart A. and P. Society	R. O. Drummond	,, 26
Adelong P. and A. Association	J. J. McAlister	Oct. 2, 3
Lismore A. and I. Society	T. M. Hewitt	Oct. 31 & Nov. 1

1907.

Society.	Secretary.	Date.
Albion Park A., H., and I. Society	H. Fryer	Jan. 16, 17
Berry Agricultural Association	A. J. Colley	,, 30, 31, Feb. 1, 2.
Wollongong A., H., and I. Association	J. A. Beatson	Feb. 7, 8, 9
Shoalhaven A. & H. Association, Nowra	W. Randall	,, 13, 14
Moruya A. and P. Society	John Jeffery	,, 13, 14
Kangaroo Valley A. and H. Association	E. G. Williams	,, 21, 22
Alstonville Agricultural Society	W. W. Monaghan	,, 27, 23
Tenterfield Intercolonial P., A., and Mining Society	F. W. Hoskin	Mar. 5, 6, 7
Braidwood	L. Chapman	,, 6, 7
Central New England P. and H. Assoct'n, Glen Innes	Geo. A. Priest	,, 12, 13, 14
Warialda P. and A. Association	W. B. Geddes	,, 13, 14, 15
Goulburn A., P., and H. Society	J. J. Roberts	,, 14, 15, 16
Armidale and New England P., A., and H. Associat'n	A. McArthur	,, 19, 20, 21, and 22
Camden A., H., and I. Association	C. A. Thompson	,, 20, 21, 22
Mudgee Agricultural Society	J. M. Cox	,, 20, 21, 22
Crookwell A., P., and H. Association	C. T. Clifton	,, 21, 22
Upper Hunter P. and H. Association, Muswellbrook	Pierce Healey	,, 21, 22, 23
Walcha P. and A. Association	S. Hargrave	,, 27, 28
Robertson A. and H. Society	R. G. Ferguson	Feb. 28, Mar. 1
Royal Agricultural Society of New South Wales	H. M. Somer	Mar. 26 to April 3
Durham A. and H. Association (Dungog)	C. E. Grant	April 24, 25
Richmond River A., H., and P. Society (Casino)	E. J. Robinson	,, 24, 25
Macleay A., H., and I. Association, Kempsey	Ernest Weeks	,, 24, 25, 26
Clarence P. and H. Society, Grafton	T. T. Bawden	,, 30, May 1, 2
Central Australian P. and A. Association (Bourke)	G. W. Tull	May 22, 23

[1 plate.]

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Agricultural Gazette of New South Wales.

Forestry.

SOME PRACTICAL NOTES ON FORESTRY SUITABLE FOR NEW SOUTH WALES.

[Continued from page 897.]

J. H. MAIDEN,
Government Botanist and Director of the Botanic Gardens, Sydney.

XVI.

The Sand-drift Problem in New South Wales.

SYNOPSIS.

Introductory.

The sand-drift question is of national importance to New South Wales, and may be conveniently divided into the Coastal and Western problems. Each may be treated separately, and most people will agree that the latter is the more difficult. At the same time, the coastal problem is increasing in

importance, and should be dealt with seriously, otherwise it will become a serious drain on the public treasury and on the purses of our citizens. Stringent regulations should be issued by the Government, forbidding the burning-off or cutting-down of the natural sand-binders (trees and shrubs) along our coast, except under suitable regulations.

Most, if not all maritime countries have to face the problem of shifting coastal sands. In "new" countries the indigenous vegetation has arrived at a state of equilibrium, more or less stable, in regard to the sand; but in the progress of settlement, in order to reach the land from the sea, or to get free access to the seashore from the land, the maritime border of scrub, trees, and binding herbs and grasses is destroyed. In many cases this fringe of vegetation is cut out for fuel, since timber is often scarce in the vicinity of the sea. In a word, the natural sand-binder or sand palisade is disturbed; the particles of sand, reinforced from an inexhaustible source, move over the land; the gap once opened is increased in size by the relentless sea breezes, and finally an area becomes wind-swept, and sand-swept, and desolate. It is a matter of history how the sterile "Landes" of south-western France have become fixed, and now bear forests of pine, which are the source of the valuable turpentine industry. These developments date from 1789, and the results are an illustration of the triumph of science over the forces of Nature. The state of the French Landes, to be referred to presently, was the result of centuries of neglect and of a special geographical situation, and I trust that no part of the coast of Australia may be neglected for so long a period. Nevertheless, the New South Wales coast provides many examples of shifting sand-dunes, and postponement of treating them is but leaving others to reap the whirlwind.

I. The Coastal Problem.

It would be difficult, and perhaps impossible, to ascertain the money loss which has accrued to the Government, to municipalities, and to private citizens in the suburbs of the cities of Sydney and Newcastle alone, in combating the sand-drift nuisance. Many private landowners, trustees of parks and cemeteries along other parts of the coast, have sand encroachments which they are interested in fixing. I have for a number of years taken an interest in this question, and again draw public attention to it, because I think the nuisance can be abated, provided a little expenditure be incurred and work accomplished be not allowed to be undone through neglect. As instances of what has been done locally in fighting the sand-drifts, I give notes in regard to two well-known cases.

1. Newcastle.

On the 14th October, 1886, was assented to "An Act to authorise the resumption of certain portions of land situate in the parish of Newcastle and county of Northumberland for the purpose of enabling the Government to arrest, as far as possible, the further deposit of sand thereon, and to reclaim for public purposes and dispose of the said lands as hereinafter provided."

During the year 1887 Mr. H. Czerwonka, an engineer of the Public Works Department, set to work to carry out the process of reclamation, his operations consisting of cutting down, trimming, and sloping banks along the sea shore, removal of existing old fences, shifting of sand, erection of brush fences and of new boundary fences, and planting with grass. From first to last a considerable sum has been spent on this work; numerous trees and shrubs, chiefly from the State Forest Nursery at Gosford, have been planted in the reclamation; while a resident gardener caretaker has been maintained since the planting staff has been withdrawn.

2. Bondi.

Mr. G. R. Cowdery's work in dealing with the sand nuisance in the vicinity of the tram terminus is referred to below. I would also draw attention to Mr. W. A. Smith's paper on the "Treatment of Drift Sand, as applied to the Bondi Sand-dunes" (read before the Sydney University Engineering Society, 27th October, 1902). This recounts the valuable work which has been begun by cutting off the supply of sand from the ocean by Mr. Smith, the District Engineer.

Much of Sydney is built upon sand-dunes, and the following newspaper extracts of little more than half a century ago, in regard to what is now a densely-populated part of Sydney, are very interesting. As population increases, of course an overwhelming number of people become concerned in dealing with the nuisance in cities, but problems exist where population is sparse.

October 4, 1854—The Sand Drifts.—"At Strawberry Hills, the damage done to property by the drifting sand is one of great hardship to the local residents. In some cases so much so that the houses were completely buried in the sand, and on account of the drifts up to the very chimneys. An owner of a tenement in that locality had adopted a singular expedient. In order to keep his well of water clear, he had fixed a cask upon the well mouth. But the sand gained ground, and he topped the cask with another, and so on, until now he has a dip of 15 feet of casks. The people who continued to live on the spot did so only by dint of most energetic exertions to beat back the sand-drifts, some of them using sheepskins to stay its progress. Many of the unfortunate persons were completely surrounded by mountains of sand. The Government ought to bring down a measure to arrest the progress of these drifts, which, if permitted to accumulate as at present, would probably at no distant period overwhelm the city."—Mr. H. Parkes (the late Sir Henry), in the Legislative Council.

The motion of Mr. Parkes in the Legislative Council yesterday, asserting that immediate steps are required to be taken by the Government to prevent the sand-drifts at Strawberry Hills and other places from destroying more property, was passed. Mr. Parkes, in his remarks on the subject, stated that these sand-hills had now grown so extended as to become alarming. Some of the houses had been almost entirely buried, nothing but the last row or two of bricks and the chimneys being above the ground.—16/12/55.

3. The sand-drift problem a forestry rather than an engineering question.

In New South Wales, works for the treatment of sand-drifts are carried out by engineers. In all other countries with which I am acquainted, they are looked upon as the legitimate work of the forester, and hence the planting work is given a prominence that it has never received with us, so far In France, the work was expressly transferred from the Director-General of "Ponts et Chaussées," in 1862, to the Forestry Department; in the United

States the work is in the hands of the Department of Agriculture. Engineers should, if necessary, be temporarily or permanently attached to a Forest Department for special duties. Although the coastal sand-dune works in France are best known, those in England, Holland, Germany, the United States, and Canada are very important.

4. The stages in the reclamation of a sand-dune.

Sand-dune reclamation consists of various stages :—

(*a*) Cutting off the further supply of sand from the ocean.

(*b*) Incidental discussion of the treatment of sand-dunes as carried on at Port Fairy and Williamstown (Victoria).

(*c*) Fixing the sand by means of vegetation.

(*d*) Maintenance of such vegetation.

The sand is, of course, primarily brought from the sea by the action of winds and waves. The deposit on the beach is dried, and is then blown by the prevailing winds, forming dunes. Our most violent gales, in the Sydney district, come from the south-east. Let us consider the above points in detail.

(a) Cutting off the further supply of sand from the ocean.

To do this, what is called the "dune littorale" is formed. The old official system of constructing the protecting dune may briefly be described as follows :—

At a distance of from 150 to 200 yards from high-water mark, a wattle fence,* some 40 inches in height, is erected, parallel to the general coast line, and at right angles to the direction of the prevailing wind. The drifting sand is arrested by this fence, and mounting up to windward forms a gradual slope towards the sea. After some little time, this fence is overtopped, and a second is put some 6½ feet from the base of the steep leeward slope formed partly by the sand which has been forced through the interstices of the first fence, and partly by the sand which has blown over the top, and parallel to the first fence. The space between these two fences is soon filled up, and the embryo dune assumes a certain profile. Midway between the two fences a palisade is erected. This palisade is formed of pine planks sharpened at one end, 5 feet long, 7 inches to 8 inches wide, and 1¼ inches thick. The planks are driven into the ground some 20 inches, and ¾ of an inch apart, their breadth being at right angles to the direction of the wind. As the sand drifts up the windward or west slope of the dune, it is again arrested by the palisade, though part of it filters through the interstices between the planks, and forms a steep slope to the leeward, which serves as a support to the planks. The sand now gradually mounts up, and when nearly flush with the top of the palisade, the latter is levered up some 24 inches. This process is continued until the dune is some 25 to 30 feet high, when a cordon of faggots is planted on the summit of the dune just to windward of the palisade. The palisade is now left in this last position until a third fence, which has been erected some 5 or 6 feet to the east of the leeward slope, is overtopped, and the base of the dune is increased without affecting the height by the sand blowing over the tops of the palisade and cordon. When this fence is covered, the palisade is moved back a few feet, and the sand coming over the tops of the cordon faggots fills in the space between them and the palisade. The latter is then again levered up, and the process continued until the dune assumes the final profile required. The formation of the artificial dune usually requires a period of from 15 to 18 years. The growth is naturally irregular, being dependent on the season. Steady, strong winds are the most favourable. On the completion of the dune the surface is consolidated by half burying, in a vertical position, faggots composed usually of pine branches. These faggots have usually a circumference of some 14 to 16 inches and a length of 30 inches, and are planted some 14 to 16 inches apart. Between these faggots is sown the seed of the "Gourbet" or

* Tea-tree (*Leptospermum*, &c.) would be used in coastal New South Wales.

"Marram Grass" (*Ammophila arundinacea*, Host.*), in quantity about 13 lb. to the acre. The consolidation is naturally only requisite on the summit and windward slope.†

M. Bagneris, Inspecteur de Forêts, states‡:—

The sand-dunes at Gironde, in France, are sometimes 230 feet in height, but at Port Elizabeth the greatest height of any sand ridge yet fixed is 46 feet 6 inches, while many of them do not exceed 20 feet in height; and although their appearance is arid and desolate in the extreme, they are by no means devoid of moisture. In ordinary weather the sand is moist even 1 inch or 2 inches below the summits of the ridges, and water is found anywhere a few feet below the limestone crust, in some places at 1 foot from the surface. Numerous wells, 4 feet to 12 feet in depth, have been sunk for supplying the men and animals on the work. Laurent§ mentions that the dunes in Algeria are so abundantly supplied that wells sunk to a depth of 10 feet or 12 feet contain water. Water is also found in the sands of Namaqualand. Its presence in the sand is generally attributed to capillary attraction.

Schlich|| describes a somewhat simpler method of constructing the dune littorale:—

Although air currents are capable of moving the sand along level and gently sloping ground, they cannot lift it above a certain height. Hence it is necessary, at a moderate distance (100–300 feet) from high-water level, to form an artificial hill, which is high enough to arrest the forward movement of the sand, and this is done by the construction of an artificial dune, generally called the "littoral dune." With this object in view a continuous line of paling is erected, consisting of planks about 6 feet long by 6 inches wide, 1 inch thick, and pointed at the lower end. The planks are inserted into the ground to about half their length, an inch apart, the direction of the line being parallel to the coast. Against this fence the sand is deposited, a certain portion being forced through the interstices and coming to rest in the comparatively quiet air immediately behind the paling. As soon as the accumulation of sand approaches the upper ends of the planks, they are pulled up about 3 feet by means of levers, and this process is repeated until the artificial dune has reached such a height that no sand can be carried over the top. Simultaneously with the first erection of the paling, a wattle fence is placed at a convenient distance behind it, to prevent the sand which has passed through the paling from being carried inland; when the first wattle fence has been entirely covered, a fresh one is made to replace it. In this way the dune is forced to adopt a moderate slope on both sides, which is essential to its permanent maintenance.

Although even this modified method has been, to some extent, superseded by that of M. Grandjean, to be referred to presently, I think it should be followed, to some extent, in special cases, *e.g.*, at Bondi and Newcastle.

In M. Grandjean's method, only Marram Grass is used as a rule, but fascine work is employed in cases where neglect or accident renders this necessary. The Marram Grass is elastic, and is used as a substitute for the more elaborate system of fascines, palings, &c., already described. The grass is freely planted in rows, and the direction and closeness of the rows are modified according to circumstances. As the sand rises, the Marram, even if temporarily submerged, will push its way up and continue to grow. Finally, by judicious planting of the Marram, and encouragement of it, it is possible to obtain the "constant" for a particular spot, indicative of the height beyond which sand from the sea shore or other source is incapable of passing. When this is obtained, the "dune littorale" can be formed, and its fixation and maintenance arranged.

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* *Psamma arenaria*. See Maiden in *Agric. Gazette*, Jan., 1895.

† McNaughton, C.B., "The sand-dunes of Gascony."—*Agricultural Journal* (Cape Town), 7th February, 1895. A valuable and exhaustive paper.

‡ Bagneris, "Manuel de Sylviculture."

§ Laurent, "Memoire sur le Sahara."

|| *Manual of Forestry*, Vol. II, p. 34. See also IV, 524.

The dune littorale must have a surface as regular as possible, otherwise the wind speedily accentuates the unevenness, and creates ridges and depressions in the mobile sand which steadily increase in size. The profile of the dune littorale must be decided upon according to local experience. In regard to this, as, indeed, in regard to other points in connection with sand-dunes, the personal experience and responsibilty of the forester must be exercised.

(*b*) *The treatment of sand-dunes as carried on at Port Fairy and Williamstown (Victoria).*

I have already pointed out that Grandjean's method is in the direction of simplicity, *i.e.*, in the use of Marram Grass pure and simple except in certain cases which require special treatment.

That is the principle of the method carried out at Port Fairy, and at the risk of not confining myself strictly to the classification of items I have made, I give the following account of work carried out in Australia.

In southern Victoria is a large tract of rich basaltic soil, which produces potatoes and onions galore, and hence is called the garden of Victoria. Nearly midway between Melbourne and Adelaide is the principal port of this rich district. It was formerly called Belfast, but now Port Fairy. Agricultural land in this belt has changed hands at £85 per acre, and £70 to £75 is no uncommon figure for the best. Years ago the sand-dunes invaded this rich land, and I have seen stone boundary walls submerged by the smothering sand. The situation was indeed serious. The natural sand-binders of the district were tried with indifferent success. Baron von Mueller was applied

Marram Grass—just planted;—showing state of sand-hills before planting.

to, and in 1883 sent seeds of a number of plants he thought might be useful. These were duly sown, rather indiscriminately, and those of a grass (the Marram) came up amongst them, and attracted the attention of Mr. S. Avery, then, as now, in the employment of the Port Fairy Council. He kept this grass under observation for two years, and felt that this was the plant of

which they were in need. It was propagated by root division, as the seeds are of uncertain germinating power. This was the beginning of the planting of the sand-dunes, which has since become an important industry.

I paid a visit to Port Fairy and saw the planting in operation. The sand-dunes have been planted for 9 miles on the Warrnambool side and for 3 miles

Marram Grass -digging plants 3 years' growth.

on the Portland side. I traversed them for 6 miles, and saw six to seven hundred acres (in 1904) under Marram. The shire has taken up the planting from the town boundary towards Portland.

The Marram Grass is well established in three years, and can then be thinned out for planting elsewhere. It should on no account be disturbed for two years. The method of planting is very simple. A portion planted in each hole is as much as a man can grasp in one hand. The planting is done with a long-handled shovel, in the pure sand, and the bundle of roots should not be unduly loosed. By division of labour, one man digging a hole, a second planting it, and stamping it carefully and evenly with his foot, well drilled men can plant with great rapidity. The direction of the prevailing wind has to be studied in each case, and the grass is planted in rows 5 feet apart, with each plant of the row 2 feet apart from the other; 26 cwt. of Marram plants is required to the acre. The curvature of the rows is about 5 feet in a segment of 50 feet. The object of the curvature is to prevent the formation of straight lines, and thus to interpose obstacles to the free course of the wind through the Marram Grass plantation from whatever direction it may blow. If it be desired to plant a sand-dune, a *sine quâ non* is to *begin to plant from the land side as far as possible, working towards the sea.* Stress should be laid on this, as the natural inclination of most planters is to begin the planting as near to the sea as possible, and to work inland. I made that mistake myself.

It is desirable to complete the planting of a block as far as possible, because much depends upon the planting being uniform. An isolated plant or an isolated row of Marram may cause difficulties through setting up local eddies in the sand. If the natural sand-plants be not removed they will often cause local inequalities in the surface—hillocks or depressions in the mobile sand. Mr. S. Avery, the experienced ranger at Port Fairy, is emphatic against the use of fences or breaks in controlling the sand, on the ground that they interfere with the drifts.

Twenty-seven years ago the Port Fairy sand-hills were let as a common, and brought £5 per annum into the municipal treasury. At the same time the rich lands were gradually being reduced in value by the sand. In 1904 we find the sand-drift nuisance has long been abated, and these despised and feared sand-hills bring in an annual revenue of £400. This is made up by grazing fees and the selling of the Marram Grass to other States and countries. In fact, the success of Marram Grass at Port Fairy is so obvious that you do not hear the sand-hills talked about as a nuisance; and my opinion is that, when all the sand-hills in their jurisdiction are planted, the municipality will be crying out for more. Furthermore, the planting of Marram and the digging it up for export is winter work, and this furnishes employment for a large number of men, at 6s. a day, precisely at a time when work is slack elsewhere.

Knowing Marram Grass for a number of years, I had my doubts as to its reputed value as a fodder. But I have seen 150 cows feeding on the Marram Grass at Port Fairy, and their food was mainly that grass, with little pickings of other plants under the tussocks. The grazing over these municipal sand-dunes is a regular business. The Council charges the townspeople 6d. per head per week, and this includes taking the cows out to the Marram Grass plantations in the morning, and bringing them into the town in the evening. Any evening one may see the herdsman bringing home his mob of cows. Arrived at the main street, the cows say good-night to each other, and find their own way down the side streets, right and left, to their homes, quicker than schoolboys do. It is an interesting sight. The citizen pays the Council 6d. per head per week, and this fee includes the keep of the beast on the Marram Grass sand-hills, and the driving-out of the beast to the sand-hills in the morning and home again at night. Keeping a cow is, therefore, within the means of all.

The Marram Grass is planted on the sea-front at Port Melbourne, in an enclosed reserve, and has certainly stopped the encroachment of sand on the streets. I have known Port Melbourne for many years, and can speak with definiteness.

But the greatest work near Melbourne accomplished by Marram Grass is the protection of the "short road" between Port Melbourne and Williamstown.* The drawback of Williamstown used to be its inaccessibility to

* For full particulars, with diagrams, see a paper written by H. V. Champion, the Town Surveyor, for the Victorian Institute of Engineers, entitled, "The Construction of the Williamstown short road, and the use of Marram Grass as a sand-stay."

Melbourne. The distance of the Williamstown Post Office from the Melbourne General Post Office is only $4\frac{1}{2}$ miles, as the crow flies; but it was 9 miles by the only route available for heavy traffic up to the end of 1896. This has now been reduced to 6 miles. The trouble in maintaining a direct road was caused by the shifting sand. In fact, for 2 miles it was in a very bad condition, and in one part, for a length of 30 chains, it was almost impassable, being entirely disintegrated and destroyed by blown sand. In 1887 the Engineer of Reclamation Works in Victoria estimated the cost of raising the road to 8 feet above low water, and constructing a steel tramway and tarred metal road, at £17,500. In 1892 the Inspector-General of Public Works proposed to raise the road to the 8-feet level, form a foundation through the sand with clay embankment, and cover the roadway throughout with 15 inches of metal, for the sum of £8,000.

Both these amounts were utterly beyond the resources of the two municipalities concerned—Williamstown and Port Melbourne. The old road had been steadily getting worse, but the engineers of the two municipalities put it into first class condition for heavy traffic with a tar-paved roadway 16 feet wide, on a rough-pitched foundation, through the sand at a total cost of under £3,000. In this work they called in the aid of Marram Grass. Eight rows were planted alongside the road, and they have undoubtedly prevented the sand encroaching on the road, and having done their work, the tussocks of Marram Grass are now being superseded by a close turf of grass and trefoils. Thus a well-known public nuisance has been removed and the wealth of the community increased by means of a short and direct road suitable for heavy traffic. The work has been carried out at a saving of many thousands of pounds upon the estimates of competent engineers, and this remarkable result was rendered possible by an expenditure of £200 on Marram Grass planting.

Victoria has, in Marram Grass, given the whole of Australia a valuable object lesson, and, surely, we in New South Wales will not fail to profit by the excellent example that has been set us by some small yet plucky municipalities in the sister State.

Some day we in New South Wales will give Marram Grass that test which it has never yet received in this State. Through lack of knowledge we have planted it the wrong way. I believe that in many places all our reclamations can be carried out with Marram Grass and Marram Grass *alone*, without engineering devices.

(c) *Fixing the sand by means of vegetation.*

It became necessary in France to raise trees to pay interest on the outlay, and it may be necessary here. In certain localities the Marram Grass as a crop may pay a fair interest on the outlay, to say nothing of the great pecuniary advantage of having stayed the sand-drift; but let us consider the desirability of supplementing the Marram with other vegetation.

In France the fixation of the sand by mechanical means, and the permanent fixation by means of a permanent crop of trees, proceed simultaneously; it is obvious that the one may precede the other. In France not only is fixation

of the shifting sands readily accomplished as part of the ordinary business of the forester, but a timber crop is raised upon these hitherto waste lands. The chief timber tree is the Maritime or Cluster Pine (*Pinus pinaster*, Sol.; *P. maritima*, Poir). The trees are not only tapped for the turpentine they contain, a flourishing industry being the result, but the timber has considerable local value, and is even exported to England, chiefly for mining purposes.

"As regards the species there was little doubt 'Cluster Pine,' the 'Pin Maritime,' was already flourishing in places in the Landes." What a lesson we have here! The sagacious Frenchman uses his native and well acclimatised vegetation; the Australian seems to prefer to plant anything rather than *his* native vegetation.

I do not, of course, object to the acclimatisation of useful plants, and the Maritime Pine has proved useful here, but I would place native plants first for this particular service. In lieu of the Maritime Pine, I recommend the Norfolk Island Pine (*Araucaria excelsa*) as the main timber tree for the New South Wales coast for the following reasons:—It revels in the sea air; its narrow leaves and conical shape present comparatively little resistance to strong winds; it is ornamental in appearance, and it furnishes a useful soft wood. For a list of other plants recommended, see page 988.

Hitherto plantings of trees, &c., in sand reclamation works in this State have always been made from plants and not from seed; I desire to emphasise the desirability of sowing seed. If, however, seeding cannot take place, I would advocate the establishment of a small nursery within the sand-drift area. It need not be expensive, but the enormous advantage would accrue of plants being raised from the beginning in situations as nearly as possible similar to those they would ultimately occupy, while, as arrangements would not have to be made for their conveyance from distant parts, they could be planted out at the most favourable opportunity. We will now return to the French method of establishing a vegetable growth on the dunes.

In establishing trees on the dunes it is necessary to raise quick-growing shelter bushes (technically known as "nurses") at the same time. The "nurse" I would recommend for Norfolk Island Pines is Tea-tree scrub, and particularly *Leptospermum lævigatum*. The dune is divided into strips 50 or 60 feet wide, and protected, by means of a fascine fence, against the prevailing wind. The strip is then planted, quincunx fashion, with Marram Grass, the centres of the plants being, say 2 feet apart, the rows 6 feet apart. The seeds of the permanent trees and of the "nurse" are then sown between the clumps of Marram Grass. The sowings should be protected with branches of tea-tree or any other scrub cheaply obtainable, sea weed, turf, &c., and the branches and other material should be pegged down, for it is of great importance that no disturbance of the surface should occur until the permanent growth or cover is established. Each season another block is similarly treated under the protection of the previous sowing, and thus an area of any required size is put under treatment. In France the plantation of sand-dunes has passed beyond the experimental stage, and there is no reason why we cannot soon say the same in New South Wales.

In the Landes, at the present day, the sowings are made from east to west in the area protected by the dune. Of course, the sea (Bay of Biscay) is on the west.

Under the old system in France it was the other way; sowings were commenced immediately under the dune and proceeded westwards. This necessitated the continual shifting of the wattle fence erected to the east of the sowing to protect it from easterly winds, whereas by sowing in the contrary direction one sowing protects the next from these winds, while the dune protects the whole sufficiently from the west, and the cost of this fence is saved in all but the eastern belt of each block. As soon as the first block is completed, a second is commenced to leeward, under the united shelter of it and the dune littorale. When this second block is in due time finished, a third is begun, and so on, the work of afforesting being steadily pushed forward until the entire area is reclaimed.*

I give two extracts from a valuable paper, † one showing the seeds deliberately planted and those which spring up accidentally from the refuse, and another showing the trees planted for revenue purposes. As regards the latter extract, it must be remembered that New South Wales is very much more richly endowed as regards tree wealth than is Cape Colony; and therefore what would pay in the latter colony would not be remunerative in the former.

The method of working in practice on the Port Elizabeth sands is to sow broadcast—about 35 lb. per acre—a mixture of seeds, composed principally of *Acacia cyclopis* and *Acacia leiophylla* (*saligna*), with an addition of *Acacia pycnantha*, *Pinus halepensis*, rye, pypgrass (*Ehrharta gigantea*), &c., and then to spread immediately a layer of refuse. Sunflower and lucerne seeds have also been used with very satisfactory results. Tomatoes and pumpkins grow freely, being self-sown with the refuse; and from areas spread with stable-sweepings a large crop of oat hay is reaped annually. In 1895 some 4,000 bundles were harvested from the reclaimed sands, and about 8,000 bundles in 1896 and 1898, at a cost of a little over 1d. a bundle. The market price would have been at least 6d. a bundle.

Plants and Trees used for Reclamation.—Numerous varieties of trees have been experimented with, but, so far the *Acacia saligna* and *A. cyclopis* have proved the most useful revenue-producing plants. The bark of the former is a marketable commodity, containing a good percentage of tannin, but the bark is said to impart an unpleasant smell to the leather. The *cyclopis* bark is of no commercial value, but the timber of both trees is used for firewood, for which there is a large demand in all South African towns, for domestic use. Many other Acacias have been tried, some of them far richer in tannin than the *saligna*, but the results have been disappointing. Among these are the *Acacia pycnantha*, *A. decurrens*, and its variety *A. mollissima*.

At Bondi and on our coast dunes generally, the sea is on the east, and the winds to protect our plantations against are strong westerlies, hence the plantings should take the reverse direction to those of western France. The soil of the Landes is nearly pure silica, while underneath in places is an impermeable substratum of ferruginous sandstone, locally known as "alios," usually from 9 to 15 inches thick, and at a depth of 10 inches to 2 feet below the surface. We know this to our cost at the Centennial Park, Sydney, an area which gives one much experience of sand planting. Speaking generally,

* C. B. Naughton, *op. cit.*

† "Reclamation of Drift-Sands in the Cape Colony," by Charles Dimond Horatio Braine, *Journ. Inst. Civil Engineers*, Paper No. 3,353, 1902. Reprinted in *Agric. Journ.*, Cape of Good Hope, xxiii, 161 *et seq* (Aug., 1903), with two illustrations of buildings encroached upon by drift-sand and one of a tree left in the air by reason of the soil being blown away; these three from the Western Lands (N.S.W.) Report, 1901. A fourth photo. of planting Marram Grass has been taken from the beginning of work on a Port Fairy (Vic.) sand-dune. The origin of these four illustrations is, through inadvertence, not stated.

I do not doubt that the "soil" conditions are much the same on the coasts of France and New South Wales.

In the vicinity of cities, *e.g.*, Sydney and Newcastle, the soil may be more or less enriched, without much expense, over limited areas; this is, of course, a local circumstance. If opportunities be watched, road-sweepings and soil can sometimes be obtained for little more than cartage. Even if grass alone be required, it will be found that it is advantageous to top-dress it with soil, while arrangements should be made to secure all the available manure in the vicinity, and top-dress with it. It is a matter of common observation that many people allow the manure of horses and cows to go to waste, and some of them would even cart it free for some little distance, particularly if the municipal by-law in regard to the storage of manure in confined areas be rigidly put in operation. A small area of ground could be set apart at the sand-drift for the storage and rotting of such manure, and it could be applied to the grass and plantation when convenient.

But where soil is not available, ashes (couch grass runs rapidly on cinders and ashes), shale, and other débris may be useful—at least for forming a covering of grass. Adjoining the sand-drift at Newcastle, the Australian Agricultural Company are the owners of a considerable block of land, which is used for colliery purposes. The company has for a considerable time been in the habit of depositing shale and worthless coal on a large area of this land, which consisted of shifting sand. The result has been that the sand is fixed, and grasses and other vegetation have already attached themselves to the soil (so-called), completing the fixing process, and forming what will be in a very short time an excellent sward.

A similar policy has been followed by Mr. G. R. Cowdery, Engineer for Tramways, in regard to the shifting sands in the vicinity of the tramway terminus at Bondi. Here the sand filled up streets and obliterated fences, becoming a nuisance and an eyesore to the travelling public. Mr. Cowdery levelled the sand and top-dressed it with a few inches of ashes from the tramway engines. A little Couch grass (*Cynodon dactylon*) was dibbled in here and there, and now we have a grassy lawn. Alongside, serving excellently for purposes of comparison, we have a neglected area, as unsightly as the tramway portion is neat. Further, the portion untreated with a layer of ashes is not only unsightly, but is a nuisance to the adjoining land, as it plentifully besprinkles it with sand at every high wind. The cinders, ashes, shale, &c., should be spread on the surface to a depth, if possible, of 6 inches.

The element of time.—One of the broad dunes on the Landes may be planted according to fixed plans requiring thirty years for their completion. And as regards the exploitation of the timber upon it, it may be mentioned that the rotation at the Forest of La Teste is sixty years for example,—that which began in 1890 will only be complete in 1949. It is necessary to emphasise these points because we are often in a hurry in New South Wales, and some people think plantations may be formed in pure sand and produce merchantable timber in a space of time that experts know to be out of the question.

(d) Maintenance of the vegetation.

It is a common human failing that we are often satisfied when we initiate a work, and we forget to provide for adequate maintenance. Adequate maintenance in the matter of sand-drift prevention is the life-blood of the whole enterprise. All these sand-drift areas should be placed under the control of the Forest Department, which should have a special staff of officers to deal with reclamation matters (including such works as the reclamation of river banks).* All areas under treatment should be regularly visited and reported upon, a printed schedule of questions being answered by the inspecting officer periodically.

(1) *Protection against fire.*—This is a matter of very great importance. Our bush-fires are, in some years, very serious agents of destruction, and it is not easy to lay down useful rules to cope with them. As regards the coastal plantings on sand-dunes, the making of fires should be prohibited under heavy penalties. In many places, the plantations will be naturally protected by the heathy country which runs along the coast line.

(2) *Fencing often necessary.*—And now I make a few recommendations applicable to planted sand-drifts in the vicinity of large centres of population. At one sand-drift reclaimed by the Government, I have seen horses, cattle, and human beings breaking down the sand-banks. The caretaker slopes the sand, plants grass, &c., upon it; cattle tear out the grass, bring down the sand in large masses, and, consequently, destroy the surface with their hoofs. Horses run along the shore for exercise and their owners sometimes put them on the slopes, with a result most disastrous to the reclamation. People have free access to these sandy slopes facing the ocean; they break them down, and with cattle, horses, dogs, and human beings, it is a wonder to me that there is any growth on these places at all. There is but one remedy, and that is the rigorous fencing off above high-water mark. A substantial fence should be erected, barbed wire being freely used in its construction, the wire so close that not even the smallest dog could get in. Trespass within the enclosure should be severely punished. I have emphasised the question of absolutely excluding the public, for this is the beginning of everthing, and no more laxity should be shown than is in the case of upkeep of the dykes of Holland. The works at Bondi, recently undertaken by the Public Works Department, are not respected as they should be by a few selfish people. They break through the fences and trample within the enclosures to make short cuts, and this can only be stopped by severe measures.

5. Plants recommended for coastal sand-dunes.

And here I would again assert an axiom in soil-reclaiming experiments. *Use the local indigenous plants to the fullest extent.* They have arrived at their present development through a long course of environment. They have the additional advantage that in many cases they are on the spot.

* This series, Part IX, June, 1905.

Indigenous Trees.

Araucaria excelsa, A. Cunn. The Norfolk Island Pine.
Langunaria Patersonii, Don. "White Oak" of Norfolk Island.
Cupania anacardioides, A. Rich.
Melaleuca leucadendron, Linn. "Broad-leaved or White Tea-tree."
Casuarina glauca, Sieb. Salt-water Swamp Oak.
Pittosporum undulatum, Vent. The common Pittosporum.
Banksia integrifolia, Linn. f. "White or Entire-leaved Honeysuckle."
Banksia serrata, Linn. f. "Red or Saw-leaved Honeysuckle."
Eucalyptus saligna, Sm., var. *botryoides*, Maiden (*E. botryoides*, Sm.). "Bastard Mahogany" or "Bangalay."
Eucalyptus robusta, Sm. "Swamp Mahogany."
Endiandra Sieberi, Nees. A "Corkwood."
Ficus rubiginosa, Desf. "Port Jackson or Illawarra Fig."
Metrosideros tomentosa, A. Cunn. The "Pohutukawa" or Christmas tree of New Zealand; a gorgeous red-flowered species.
Pittosporum crassifolium, Bks. and Sol.; and other New Zealand species.

Exotic Trees.

Pinus pinaster, Sol. (of which P. *maritima*, Poir. is a synonym). The Maritime or Cluster Pine.
Pinus insignis, Dougl.
Ailanthus glandulosa, Desf.
Robinia pseud-acacia, Linn.
Cupressus macrocarpa, Hartw. "Monterey Cypress."

Indigenous Shrubs.

Correa alba, Andr.
Acacia longifolia, Willd., var. *Sophoræ*. "Spreading Coast Wattle."
Leptospermum lævigatum, F.v.M. "Tea-tree."
Melaleuca ericifolia, Sm. "Bottle-brush Tea-tree" and other *Melaleucas*.
Angophora cordifolia, Cav. "Dwarf Apple."
Myoporum acuminatum, R. Br.
Westringia rosmariniformis, Sm.
Monotoca elliptica, R. Br. "A pigeon-berry Ash.'

Let me particularly emphasise the value of *Leptospermum lævigatum*, Nature's special sand-stay for many parts of coastal New South Wales. It is best developed about Melbourne.

Exotic Shrubs.

Tamarix gallica, Linn. The Tamarisk.
Lycium Afrum, Linn. African Box-thorn.
Lupinus arboreus. The common "Tree Lupin" of Californian sand-hills.
Salix acutifolia. "The Sand Willow," which has done much to bind shifting sands in Russia.

Indigenous Grasses.

Spinifex hirsutus, Labill. "Spiny rolling Grass."

The coarse creeping stems attain an enormous length (I have followed them 30 or 40 feet), powerfully rooting at the joints. On the principle that "a prophet is not without honour save in his own country," the merits of this native grass are apt to be overlooked in contemplation of the imported Marram Grass, whose merits I do not for a moment deny.

Festuca littoralis, Labill.
Cynodon dactylon, Rich. "Couch Grass."
Zoysia pungens, Willd. "Coast Couch Grass."
Imperata arundinacea, Cyr. "Blady Grass."

Exotic Grasses.

Psamma arenaria, R. et S. (Syn. *Ammophila arundinacea*, Host.) "Marram Grass."

Stenotaphrum americanum, Schrank. "Buffalo Grass; the "St. Augustine's Grass of the United States."

Saccharum arundinaceum, Retz. (Syn. *S. cilare*, Anders.). The "Mung-grass" of India.

Duthie* speaks of the value of this grass in sandy ground near rivers :—

These hills are composed of absolutely pure blown sand, but the grass, if planted in tufts during the rainy season, strikes root and very soon effectually retards any considerable advance of sand particles. Encouragement is thus given to the growth of other plants, which are less able to endure submergence in sand, and in this way the ground becomes reclaimed.

For a further account of this grass, see *Dict. Econ. Prod. India,* VI (Pt. 2), p. 2.

Saccharum spontaneum ("Kans-grass").

Plays an important part in the process of reclamation. Kans possesses an enormous amount of vitality in its stems, which are capable of producing plants at every node and joint.—(Duthie, *op. cit.*)

For a further account of this grass, see *Dict. Econ. Prod. India,* VI (Pt. 2), p. 11. Both of these grasses are coarse, and are only eaten by cattle when young.

The value of *Paspalum dilatatum* and Rhodes Grass (*Chloris virgata* and *Gayana*) for sand-binding purposes has not been thoroughly tested in New South Wales yet. *Paspalum* proved useful on the Macleay River in a case in which I recommended a farmer to try it. A large area of good land had been completely covered with a thick layer of sand brought down by a flood.

Small Plants (non grasses).

Mesembryanthemum æquilaterale, Haw. "Pigs' Faces."

Lippia nodiflora, Linn. A plant belonging to the Verbena family, which forms a mat in nearly pure sand. Well established in New South Wales.

Lippia repens is a smaller plant than the preceding, which is being tried in New South Wales in various localities to cover bare patches in which no grass will grow, and so give the appearance of a lawn.

This list can be indefinitely extended.

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* Report on Mr. C. E. Gladstone's planting and grass-sowing operations in the Umballa district (India)—*The Agricultural Ledger*, 1896, No. 21 (Agricultural Series, No. 18).

(*To be continued.*)

The Staging of Bees and Honey Exhibits

ALBERT GALE.

The line of demarcation that separates success from failure, or failure from success, is a line so fine that, to the eye of an exhibitor at agricultural shows, it fulfils Euclid's definition of a line—length without breadth—and exists in the mind of the judges only, and they, poor fellows, come in for a good deal of slating. for having courage enough to state their honest convictions irrespective of pleasing or offending exhibitors. When one accepts the office of a judge in any section of an agricultural show, he knows that if there are a

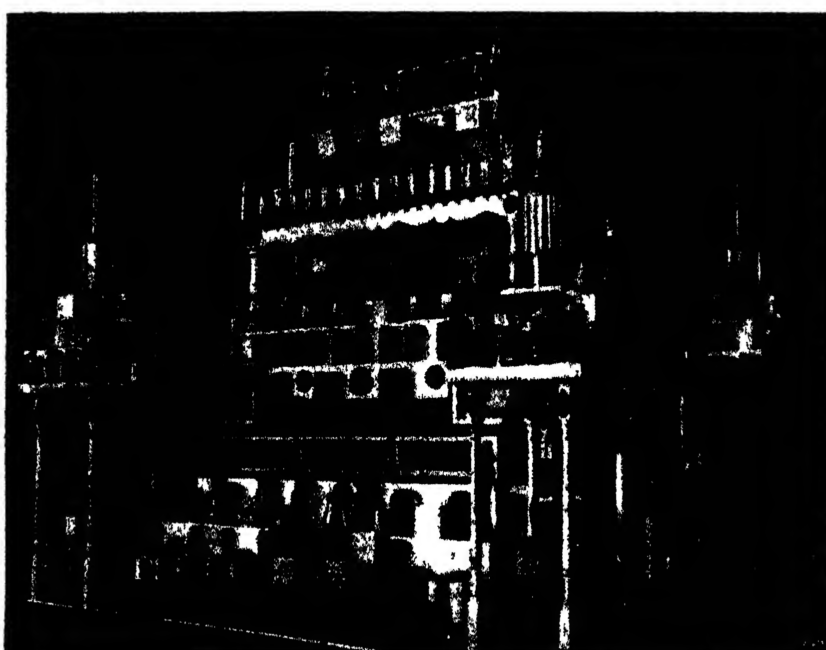


Exhibit in trophy form.

hundred exhibitors in his section he is bound to bump against ninety and nine more or less adversely. Judges, as a rule, are selected from among men of practical experience—in fact, experts in the particular section or class in which they are to act. An expert is a specialist in one or more particulars: one who has acquired his information by practice, use, and experience. Just as some doctors become specialists in particular diseases, having given their whole time and talent to some particular phase of their profession, so judges are, or should be, experts or specialists.

Judges go about their work with a full knowledge of the fact that many an exhibitor is as good an expert in the class in which he intends to exhibit as the one who judges it is ; but an exhibitor, in selecting his intended exhibit, labours under the disadvantage in not being able to compare his goods with other competitors, and judges only award by selecting the best in the class by comparison. Failure is too often the result of the carelessness of an exhibitor. Let me deal with the various classes of goods exhibited under the name of bee products, because I have a more intimate knowledge of what goes on with these than aught else, and my remarks will have more to do with country shows than with the metropolitan.

Liquid Honey.—Too frequently the bottles are not selected with regard to a unicolour tint, which gives the contents the appearance of not being of a uniform grade. Imperfect clearness of the glass, *i.e.*, its being speckled with opaque substances, is reflected in the honey, and, therefore the contents of the bottle get the credit of the impurities of the glass. Ofttimes a bottle, after it is washed, is permitted to drain, and the internal surface not polished, thereby leaving streaks and blurs, the honey reflected through it appears to be cloudy. Judges are as careful to search for faults as perfection, and there is no doubt that many an exhibit has been rejected on account of the imperfections above narrated. The usual number of bottles required for a class is twelve, and it is highly important that the honey in the whole dozen should be of a uniform grade. I have seen more than once three or four bottles of first-class water-white intermixed with light amber. In the opinion of judges there is no greater detriment than a want of sameness throughout an exhibit. Not infrequently do we find honey of a first-rate quality as to colour, but defective because two or more grades of honey have been mixed, for some purpose or other best known to the exhibitor. The honeys used in blending, not being of the same tint, must always more or less leave their mark behind them in the form of cloudy samples. The cloudy appearance seen in some honey staged for show purposes is sometimes due to granulation. Judges detect the difference between clouded honey, caused by blending, and granulation, because in the latter the granulation commences at the bottom of the jars like a sediment, and the cloudiness caused by blending is seen throughout the whole sample. Again, some really good samples of honey fail to score a merit for want of density. At one show, where I acted as judge, there was staged a water-white sample that was really water-like, its density, if I may use the term, was of such a liquid nature. The main cause of these extremely liquid samples is that they have been bottled in an unripe stage. Of course, there is a class now set apart for water white honey distinct from amber coloured. It was a wise step to make a distinction between these colours, for both have their votaries. The remarks here made apply to honeys of both classes.

Granulated honey is not open to the same amount of criticism as that of liquid. Nevertheless, granulated should be such that its firmness is the same from the top to the bottom of the jar. Too frequently the granulation is imperfect, giving an observer the opinion that it is neither one thing nor the other, *i.e.*, you cannot tell whether it is liquid or granulated.

Comb honey, when exhibited in 1 lb. sections, is one of the most interesting and at the same time one of the most admired forms in which honey is staged. It appeals to the onlooker in its most appetising form, and at the same time demonstrates the producer's skill—that is to say, that of the bee-keeper, not the bee. For a beekeeper to produce first-class sections and other comb honey, he has to be a master of his business. The get-up in the 1 lb.

Technical Exhibit—Comb honey.

sections is everything. The wooden frame surrounding the honey should be scrupulously white and free from all blemishes. All propolis should be removed. The beautifully white capping of the honey should be perfect; free from travel stain, free from finger marks, free from bruises, free from weeping. Often a small puncture in the capping causes the honey to exude, and thus damage the merits of the whole exhibit. The frame or section must be complete; no uncapped or empty cells, and the fewer pop-holes the better. The comb should extend to the four sides of the frame as completely as possible, and the pop-holes in the four corners of the frames should be absent in all sections. When the competition is keen the judges are glad to avail them selves of any little imperfection so as to add merit where merit is due.

Wax.—Yellow and white are the two classes usually in this section. In either yellow or white, purity is one of the great merits looked for. The exhibits should be cubic in form; free from flaws, and especially free from dross (perhaps I had better say sediment); tenacious, and yet when broken should have a granular appearance; free from blotches and specks; unstratified. In both yellow and white it should be of one unicolour tint throughout.

Trophies.—These are not like the laws of the Medes and Persians. The forms of trophies alter, and rightly so. No hard and fast rule can be named. Artistic taste is everything. The schedule of prizes may name the requirements in other classes; the style of comb required; the tint of liquid and the grain of the candied honey; and the colour of wax suitable for manufacturing purposes; but when it comes to trophies it has to content itself with the one phrase, "bee-products in trophy form," and so long as all the conditions named are carried out, the form and get-up of these most attractive of all the

exhibits in the bee and honey pavilion is left entirely to the judgment of the exhibitor. The obtaining of the prize for the trophy is always of considerable monetary value, and carries the "blue ribbon" with it. Of all the exhibits contained in the show-room there are none that require more careful investigation than these trophies, and the judges spend a deal of time in consideration before coming to a final decision. First, there is the design to be adjudged; then, what bee products is contained therein; then, are all the exhibits on the trophies genuine—that is to say, are there any dummies amongst them?

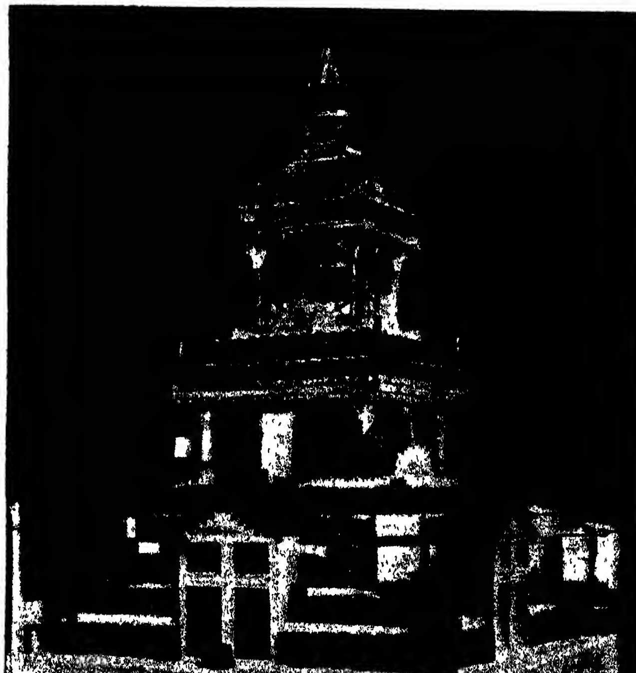
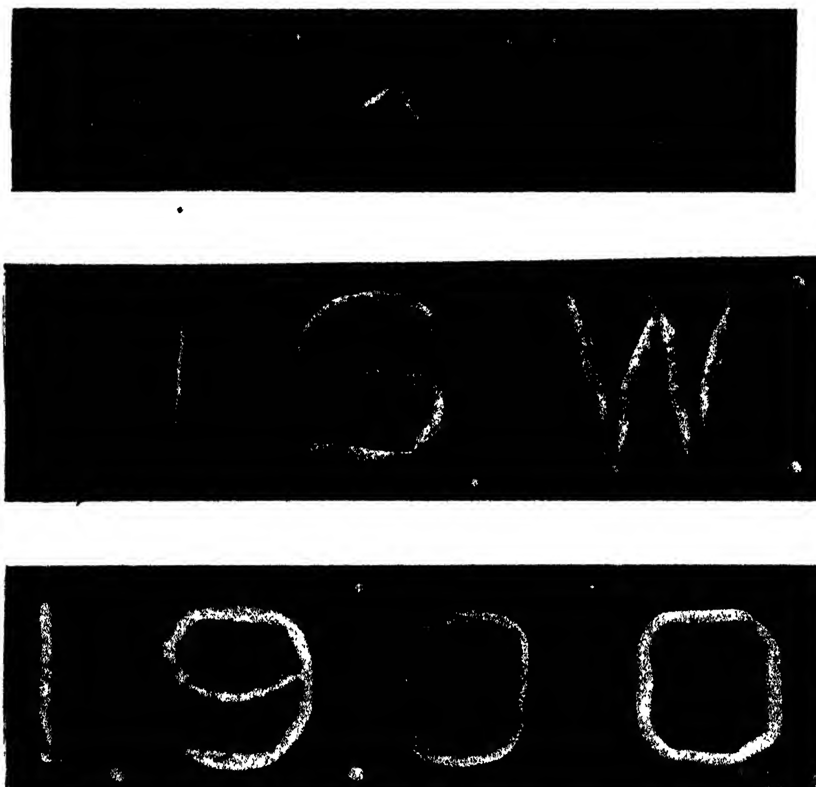


Exhibit in trophy form.

Bees.—The most essential item in staging bees is to arrange the exhibit in such a manner that the judges shall have no difficulty in the task assigned them. In bees the greatest trouble judges have is to find the queen. To aid the judges in this work the exhibitors can do much; in the first place, not overcrowd the observation hive with too many of the progeny of the queen, and also note that the frame of comb so fits the observation frame that the queen cannot escape from one side of the comb to the other. If a strip of queen-excluding zinc be fitted around the frame of comb so as to permit the workers to pass from side to side to the exclusion of the queen it will save a great deal of the time in judging.

There is one thing the Bee Association might do to increase the attractiveness of their pet hobby, that is, offering a prize for the most artistic design wrought in honeycomb by the bees. From the inception of these competitions amongst beemen the exhibits have been continually growing in number and quality. In the year 1900, there were exhibited designs wrought out by the bees themselves, aided in their design by the beemaster—the letters B.K.A.



Artistic designs wrought by bees.

(*National** Bee Keepers' Association), N.S.W., and the figures 1900—as will be seen in the illustration. There is no reason why any design that may strike the artistic imagination of the beekeeper should not be worked out. Curves are the most difficult forms that bees can produce, nevertheless the curves in the letter S are a sufficient trial to test the skill of the tiny workers in designs of merit for exhibition work.

* The letter "N" is omitted from the illustration.

"Fibro-Cement" Silo

CAPACITY, 100 TONS.

E. G. STONE,
Studleigh Park, Werrington, near St. Mary's.

IN a recent issue of the *Sydney Morning Herald*, a description was given of a new form of silo, erected upon my farm at Werrington, and which has proved successful in every way. It is thought that the information given there, with further details of construction, would be interesting, and perhaps helpful, to all who need to conserve fodder in this way—that is to say, dairy-farmers, stock and sheep owners.

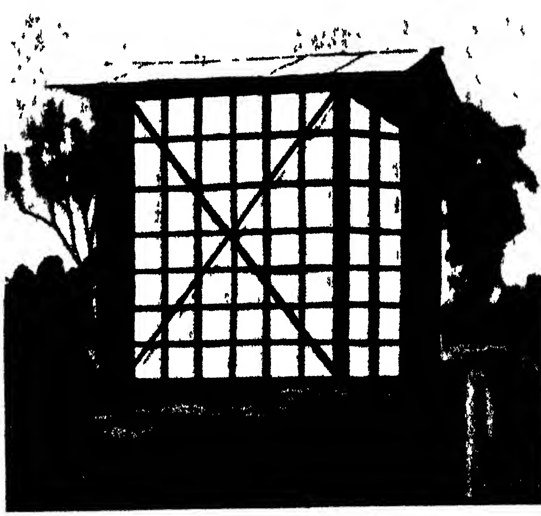


Fig. 1.—Perspective View of Silo.

There is hardly any need now to point out the advantages of the silo upon the farm. It is fast becoming recognised that in a country of uncertain rainfall it is impossible to carry on successful farming where stock is concerned without one. But as there is much up-to-date machinery that farmers would like to own, and which would doubtless pay interest on capital, but which must often be done without, so is it with the silo. The first cost is so great that many are debarred because of this from erecting one. But there is often this essential difference between the expenditure upon machinery and that upon the silo, that in the latter, given a full silo, and one dry season following, then the whole of the capital expended, together with interest, would easily be returned, even taking the most expensive forms that are now constructed.

When special crops are grown for ensilage, the economical farmer will not put these into a stack, or even into an unlined pit, because of the excessive waste. And it is only upon score of emergency that the construction of these are warranted. This being fully understood, it is only worth while to consider the different forms of tub silos, as to their respective merits, in all cases taking a capacity of a hundred tons as a basis of comparison.

Amongst the permanent silos can be classified the concrete, the Monier or ferro-concrete, the masonry, and the brick, all of which are finished on the inside with a cement rendering. These are chiefly made circular in form, although I have photographs of American silos erected on polygonal plans. They are either altogether in or out of ground, or partly in and out. While these silos if well built might conceivably last for ever, the first cost is so great in most cases as to prohibit their use. From £120 upwards would be a fair estimate.

The next, and most common form, is the circular, built in timber, usually Redwood or Oregon. It consists of vertical boards with grooves, and slips for tongues; it is strengthened and clamped with iron hoops, with doors suitably arranged for filling and emptying. Usually the filling is done at the top, although with blower elevators, used so much in America, the doors used for emptying are also used for filling Of this form, the silo at the Hawkesbury Agricultural College, and also at the Newington Asylum and the Government institutions, are typical examples. Timber, because of its nature, cannot be considered as permanent, but the life of these can be taken between forty and fifty years, although, perhaps, before that time, some of the timbers might need renewing for dry-rot or other defect. The cost of this form is about £100, which is high in comparison with the more permanent, but the necessity to have skilled labour to erect it brings up the price. Added to this would be the cost of painting every three or four years, which would probably favour the permanent silos at the end of the life given above.

The third form that has been used consists of a wooden framing, upon which is secured flat iron, galvanised or otherwise. This has been used in Victoria within the last few years, and is cheap in its first cost—about £40 being a close estimate. Although this form is cheap in the outset, it will not prove so in time. The fermentation and heating of ensilage very quickly corrodes all forms of iron or steel work, and to the first cost would have to be added the cost of painting or tarring (which would have to be well done in any case). This upkeep would be great, for it would almost certainly require to be done every time the silo was emptied, or probably about once every year. The woodwork would require paint every three or four years, as in case of No. 2 form. I do not think that this form of silo is to be recommended.

In addition to the forms mentioned above, there is yet another, which, although untried, has been fairly well demonstrated in a model at the Hawkesbury College. This invention consists of a framework of hardwood timber, eight-sided on the outside, but by an ingenious arrangement is made sixteen-sided on the inside. This interior is lined with lining-boards and

damp-proof paper. This form will prove good, but there will always be trouble by the filtration of air through the many joints in the lining; for no matter how well lining is cramped up, in time the joints will open out, and, of course, with air will be a corresponding loss in the ensilage. It will be small, but worth considering.

Of all the types mentioned above, as an economic problem, the permanent types first mentioned should prove the best in every way, making the greatest quantity of best ensilage. But with the lining I use, a permanent silo can be made for about half the cost of those mentioned in the first case. To erect a permanent silo, I use steel sections, and bolt the lining to them so that the ensilage only comes in contact with the sheets, but if timber framing is used, as shown in the block of my silo, the cost would be less than half, and almost permanent. For, using hardwood timbers, and these being comparatively few, the upkeep is small, for once the lining is rendered water-proof by silicate, nothing further need be done to it. This lining, which is the main feature of the silo, is a recent invention, called "Fibro-cement," non-compressed. It is a composition of cement and asbestos, which is absolutely fireproof, and durable. When first the sheets are taken from the cases, great care is needed in handling, for the stuff is unmatured, and brittle, but upon exposure to the atmosphere it hardens. But it should be erected in an unmatured state, for it is nailed to the wooden framing, and when unmatured, the nails can be driven quite close to the edge without fracture of any kind. The great size of the sheets, 8 ft. $2\frac{1}{2}$ in. x 4 ft., does away with many joints, but if thought advisable, another size could be used, 4 ft. x 4 ft. I advise the larger size, although taking more care in the handling. For those who wish to erect their own, I attach the method of construction I adopted.

Top and bottom plates are mortised to receive the vertical studs which are tenoned, put in place, and cramped home with a twitch, and then nailed. The studs are notched out for 3 in. x 1 in. battens, which are let in flush, and well nailed, the braces, 3 in. x 1 in., are secured on the outside, as indicated in the block. It is advisable to do all this work on the ground set out accurately at first, so that when raised it can be put together without trouble. The sides I lifted up in their place with levers and props, and fixed vertical, bringing each together, the ends of all plates having been halved to suit each other. The corners were fitted in position. The sheets carried on edge are raised to a temporary platform on the inside, and nailed to top of framing first, with clout-head nails 1 in. long, spaced about 4 in. centres. In the corners before nailing the sheets, a strip of Malthoid dampcourse is tacked, and coated with their prepared cement, and the sheets are nailed over it while the cement is wet. The joints between the sheets are pointed with Portland cement grout, two of cement to one of sand. A door hinged to frame part of roof is provided for filling, and special form of doors for emptying are shown in figures 5 and 6. I intend to fix an elevator driven by an engine to raise ensilage, but of course this could be done in various other ways. The roof is built upon ordinary principles, but in my silo it

is covered with the "Fibro-cement" sheets. The foundation and floor can be left to one's own discretion. I used Pisé (rammed clay and gravel), and it answers well, but of course brick or concrete could be used. With reference to the form in plan, my silo is octagonal, not equisided, but it could be made almost any form to work in with the sheets. If it were made equisided it would hold a few tons more, but the roof construction would be more difficult. This method of using other than round frames is not uncommon in other countries, and an octagon being so near to a circle, answers as well in my experience. To make the sheets waterproof, two coats of pulver silicate, or two coats of white ferol, answers best. The timber could be coated with pulverite, with ferol, or with other paints, but both of these paints are easy to put on, and hard to come off. An estimate of cost slightly revised since my letter to the *Herald*, the quantities being fairly exact:—

	£	s.	d.
Fibro-cement sheets, non-compressed, 200 square yards, at 2s. 6d. ...	25	0	0
Hardwood, other timbers, and sundries, 19 squares	15	7	0
Guttering-down pipe, &c.	1	0	0
Cement, 3s. 6d.; nails, 2s. 6d.; silicate, 15s.; paint, £1 10s. ...	2	11	0
Dampcourse, 3 rolls 4½ inches	0	17	0
	£44	15	0

This is for material only, and does not include freight. The labour for this silo might be put down at £10, for mine took one man (and a couple of hands at odd times to lift) three weeks to erect. This would make a total of, say, £55, which is, as I have stated, less than half the cost of permanent silos mentioned first.

The advantages of this form of silo are many, viz.:—

1. A bush carpenter can frame, and erect it.
2. Its extreme cheapness.
3. Its permanence.
4. The smooth interior enables the ensilage to be cramped tighter than in any other form.
5. No joints practically for air to enter.
6. Ease of carriage, thus reducing freight.
7. One side of the same framing can be used for future extension.

These are the advantages of this novel form of silo, and the information may be useful to any who are looking for a cheap, and good, silo. For the further guidance I may say that the sheets can be obtained from Messrs. James Hardie & Co., 11, Macquarie-place, Sydney, and for any further suggestions, perhaps I could forward them, but I think the article as written contains everything needful. I understand the agents for the "Fibro-cement" sheets are making arrangements to have stock silos made, to send away to any part, lettered for ease in erection.

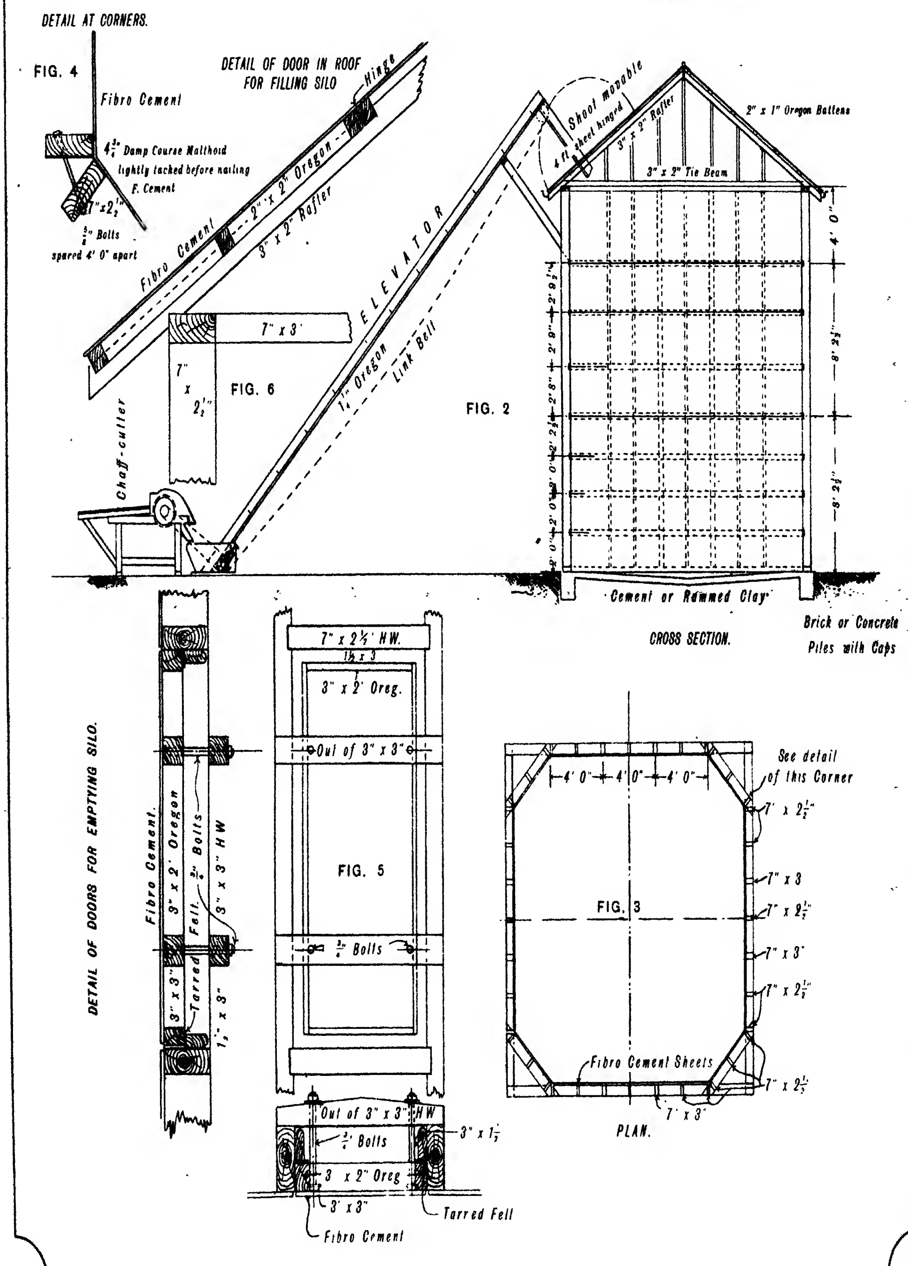
REFERENCE TO PLATE.

Fig. 2.—Side view in section with elevator.
3.—Plan view in section.
4.—Joints in corners.
5.—Details of doors for emptying.
6.—Details of doors for filling.

FIBRO CEMENT SILO

CAPACITY, 110 TONS

Designed by E. G. Slone.



Caponising.

G. BRADSHAW.

WITHIN the past few months the subject of caponising has received a good deal of attention among poultry men, due principally to the substantial prizes offered by *The Daily Telegraph* for birds thus treated at the table poultry competition in February last. Early notice was given all breeders so that they would have sufficient time to breed the birds, and have them operated upon, in order to compete for the prizes offered, and afterwards shipped to London to test the market there for this product.

A caponiser was appointed, and some twenty entries were received for the competition, but by the time of killing, a number of these, for various reasons, had dropped out, leaving two entries of Black Orpingtons, one of Wyandottes, and seven of Leghorns, all of which were duly prepared, and with the other exhibits forwarded to London. At the time of writing a cable has been received, stating that they all arrived sound and met a good market. However, by the time this appears, the secretary of the competition will, in all probability, have received details of each lot, when I think it will be found that the capons realised no more than the other poultry. This belief of mine being based on the fact that there is a great deal of misconception on the subject of caponising, quite a number believing it the royal road to profitable poultry culture. The chief object in caponising is, that by the deprivation of the organs of reproduction, the birds operated upon, rather than continue a quarrelsome life among themselves or in the company of hens, retarding their growth and becoming hard in flesh quality, they retain a sort of chickenhood for a long period, can be kept in numbers without fighting, while the flesh at nine or ten months' old is as soft as when at half that age. Concerning the question of a larger ultimate growth there is a difference of opinion, but one thing is certain, that up to eight or nine months the capons will thrive better than cockerels, besides the improvement in the flesh. However, it is the question of profit which is desired to be brought out in this article, such being largely the object of caponising; and when the returns be received of the several lots sent to England, it is almost certain they will be disappointing; and should that be the experience of those we sent to England, we need not expect any success here, as there is no actual demand for 8 or 9 lb. birds at a price payable to the producer. Caponising, as will be seen by the following exhaustive article contributed by Mr. E. Brown, is not practised largely in any country, and arises principally from the fact that four or five months' old chickens and capons, either in growth or flesh properties, are not distinguishable; while if the

capons are kept till eight or nine months of age, they have literally eaten their heads off; in other words, the food they have consumed in that period cost more than what the carcase would realise in the market. And this feature is the cause of many disappointments in hitherto attempts to cultivate this business. An illustration will suffice: A lady residing in Hurstville lately communicated her experience to the press, and is typical of the misconception on this subject, and again emphasising the old adage, that "an ounce of practice is worth a ton of theory." The Hurstville correspondent complains that her nine months' old capons, weighing 15 lb., only returned her 5s. per pair, and that she got 5s. 10d. per pair for ordinary cross-breds, which were about half the age of the capons, and cost about half the amount to rear. The lady's mistake was in imagining there was a market here for such goods. At the age mentioned, the capons must have cost fully 8s. a pair to rear. And supposing they did realise a shilling more than that in the market, the plucking and dressing would cost the poulterer a shilling, and, say, another shilling for profit, would mean that these capons could not be sold at under 5s. 6d. or 6s. each, a price at which there would not be half-a-dozen customers in Sydney in a week. For did anyone wish to spend 6s. on a poultry-dinner they would purchase a couple of cockerels, or, better still, the same amount would purchase a much heavier young turkey hen.

We have an excellent market in Sydney all the year round for plump, four or five months' old chickens, at from 5s. to 7s. per couple; and should these prices not be payable ones, I fear caponising need not be ventured on. It is worthy of mention that, although one or two of the competitors in the table-poultry competition spoke approvingly of caponising, others were as pronounced that there was nothing in it. I have just to add, that the best table poultry in the world go to and are consumed in England. These are not capons, but fatted chickens, frequently of no particular breed. And although capons are quoted in the London poulterers' shops, they are not actually so, but large, soft, roasting chickens—capon being a more euphonious trade term than cockerel.

The following article on caponising was contributed to the last edition of the late Lewis Wright's Poultry Book, by E. Brown, F.L.S., Lecturer on Aviculture, Reading College, England :—

"Both at home and abroad large numbers of fowls are sold under the name of capons, and these command the highest prices. In France we see quoted capons and poulardes, but the latter term is not met with in our own country. It is necessary, before saying anything as to the system, to consider what these terms really mean. The system of caponising, that is destroying the reproductive faculty, has been carried out for several centuries, and, so far as evidence is obtainable, was practised to a considerable extent two or three centuries ago; but it must now be recognised that the word has now largely lost its old meaning, What are called Surrey capons have not, as a rule, undergone the operation, but are simply large and more fully grown birds, distinct from what are called chickens. Although some doubt has been thrown upon the statement, there is no question that large numbers of cockerels are caponised in France, but probably not to the same extent as was

formerly the case. In America it would appear that of late years the practice has increased, but I am inclined to think that everywhere only a small proportion of the dead fowls which go under this name, either at home or abroad, can legitimately be designated as capons. The term 'poularde' has no real meaning. At one time it would appear that in France it was customary to a limited extent to destroy the ovaries of pullets, with the same object in view; but I have been unable to find that this is now practised at all. Speaking generally, we may therefore assume that all large, well-grown fowls of either sex, when given the designation mentioned, are chiefly matured specimens, and that these names are used in the same way as is mutton in contradistinction to lamb, to indicate the age from which it is obtained. The value of caponising, however, we cannot ignore. All the evidence to be obtained goes to show that the effect of the operation is a beneficial one so far as the quality of the meat is concerned, and fowls treated in this manner retain the tenderness of chickens for a much longer period than would be the case under natural conditions. But there is a further advantage, especially in the case of cockerels. Everyone who has had any experience with the rearing of fowls in large numbers knows the difficulties arising in keeping cockerels, and upon that ground alone there would be sufficient justification for the adoption of the system. Where operations are upon a smaller scale, and especially in establishments where enclosed runs are employed, it is not at all difficult to keep the cockerels altogether apart from the hens and pullets. This, however, is not so on the farm, where the birds have liberty, and many complaints have been made as to the trouble arising in this way. The principle is one that is recognised in the case of larger stock. Whether the process is a paying one must depend upon many things, chiefly whether a demand can be obtained for large birds in the autumn months of the year, at prices giving an adequate return for the food and labour expended in keeping them right through the summer. Caponising is of no use whatever for chickens, and should be only employed when it is intended to keep the birds until they are eight or ten months old before killing.

"A chicken would be in fit condition for fattening about the time when the operation should take place. The effect of this operation is to retard the growth, but, at the same time, to prolong it; and although some experiments have been made in America, at the Rhode Island Experiment Station, which did not warrant the statement that capons ultimately make larger birds during the first year, there is ample evidence on the other side.

"Many people imagine that young birds may be caponised and marketed within a few weeks. This is an absolute mistake, and it will be found that such capons would be less profitable than if fed off and sold as cockerels.

"There can be no question that the operation is one which requires skill and care, but the amount of pain is very small, and, as a rule, birds suffer a comparatively small amount of inconvenience. In the La Bresse district of France, at certain seasons of the year, people—chiefly women—go round to the various farms and undertake the work of caponising, at so much a bird—usually, I believe, about 20 centimes.

"When skilfully carried out the loss by death is very small, and I have known those who did not lose more than 2 per cent. in this way. Taking all things into consideration, it must be acknowledged, however, that the chief value of caponising is found in the ability to retain male birds for killing in the autumn without keeping them in confinement. The gain in weight probably does not make any great difference so far as actual profit is concerned. The period at which the birds shall be operated upon will depend

upon the breed, as some mature much earlier than others. A few breeds, such as the non-sitting varieties, which are rapid in growth, should be operated upon when about ten weeks old; but others, of the slower developing breeds will not be ready until six weeks later. The best guide is when the comb just begins to spring, the cockerels usually commencing to crow at this period, and this also may be taken as an indication of the right time for caponising having arrived. When selected, the bird should be kept without food for thirty-six hours, in order that the intestines may be entirely empty. A proper set of instruments should always be used. These instruments include a knife, a pair of spreaders (for the purpose of holding open the cut), and a pair of grippers, by which the organs are seized and wrested from their connections. For this work it is desirable to have a good firm table, or if a barrel is placed end upwards, and a square board placed on top, it answers the purpose excellently. The table or barrel should be placed where there is a good light; otherwise, when the cut is made, we cannot see the position of the organs very easily. Two pieces of soft cord about 3 feet in length, and also a couple of half-bricks as weights, a sponge, and a bowl of cold water are required.

"A running loop should be made at either end of the cords, and to each cord is attached, by means of one loop, the weight named. The loop of one of these cords is slipped around both legs of the bird by the middle joint, and the vacant loop upon the other cord is placed around both wings close up to the body. The bird is then laid upon its side with its back towards the operator, and so soon as the weights are passed over the end of the table or board, hanging down at either side, the bird will be held firmly, and cannot struggle or move; thus the operator can handle it with the greatest of ease. The operator now plucks some of the feathers from the side, immediately in front of the thigh, from the ribs down to the breast. The sponge dipped in water is used for wetting the feathers around the bare places made, thus keeping them out of the way, and it also has the effect of numbing the flesh of the bird. The fingers of the left hand must find the first and second ribs, and a cut is made with the knife between them, from the back downwards to the end of the ribs. If this is properly done, immediately there is a spreading of the skin and thin layer of flesh, greatly assisting the operator. The spreader is now placed between the ribs, and the bent ends of the steel of which it is made grips the ribs, drawing them also apart, and leaving an orifice of quite an inch. The first thing seen inside is a very thin skin which has to be split by the point of a knife. When this is done the testicle will be seen below, close up to the backbone, in the shape of a horse-bean, and vary in size with the age of the bird. The usual course is to insert the grippers, pass them round the organ, taking hold of the ligature by which it is attached to the body; a sharp twitch detaches it. So soon as all has been done on one side the bird is turned over, and the process repeated on the other. After the operation, as no stitching is required, the bird is released, and it is a wise plan to give it a good feed of soft food.

"Such is the method of caponising, but those who intend to practise it should at least receive one practical lesson, and then operate on dead fowls to learn the exact position of the organs."

Since writing the above, particulars have been received of the *Daily Telegraph* experimental shipment of poultry, which included capons, the results being confirmatory of that already written. The very grand dozen

of Orpington capons, bred by Mr. W. T. Ely, of Rydalmere, which averaged 6 lb. each dressed, and described by Messrs. Edwards and Walkden, the selling agents, as "very fine indeed," realised no more than did the ordinary cockerels of the same breed and weight, namely, 4s. each, or 8d. per lb., and returning the owners, Messrs. Griffiths and Ely, 3s. 4½d. each respectively for the cockerels and capons, these instances being the two highest prices realised. The only other dozen of Orpington capons, weighing 4½ lb. each, sold at the same rate—8d. per lb.—returning 2s. 4½d. each net. These latter were bred by Mr. S. Ellis, of Botany, and will certainly pay him better than the higher price will pay the other breeder, as much more food is required to put on the extra 1½ lb. The only case of Wyandotte capons weighed 5 lb. each, and are also described as very good, but having too much spur. They returned the owner 2s. 7½d. each, being 3d. less than Black Orpington cockerels of the same weight, owned by Mr. Frame, of Canterbury. Concerning the White Leghorns, whatever demand there be in the Sydney markets for this breed, it has no advocates for an export trade; and, although there are now reflections about sending them to London, it must be remembered that the shipment was just to test the market, and now that that has been done, it can be safely said that Leghorn capons will not be again consigned to the English market. The capons of this breed realised, net, from 1s. 1½d. each to 1s. 10½d. Whether this system of treating Orpingtons will be continued or not, it is scarcely likely that Leghorns will be subjected to the operation. In the Sydney markets, throughout the year, many cockerels of this breed are weekly marketed, and for well-fed quality birds good prices are obtained, but these are not specially produced for market purposes, but are rather the cockerels from the flocks which are largely bred for egg-production in the Sydney suburbs.

In connection with all I have said above, the following extract from *Feathered Life*, an English utility poultry paper of last month, will be opportune:—

"Many breeds of poultry do not pay to produce for table. It is not altogether a matter of size. An Indian Game pullet looks small, yet this is the only breed that will fatten naturally—that is to say, can be marketed and sold as first-class stuff, and yet receive no special treatment beyond liberal feeding. Other breeds have to be shut up to fatten. A sign of the times is the small number of capons sent to market. If you ask your poulterer for a capon, he will supply it, but it will not be a caponised fowl, but a fattened Surrey cockerel. Yet our literature teems with allusions to capons—a common luxury among the well-to-do from very early times down. The explanation is, that a capon takes time to grow. It should not be killed till it is ten or twelve months old, and breeders find it pays better to fatten their young birds and market them at four to five months old. A Sussex fowl, if handled by a man who knows his business, hardly ever fetches less than 4s. each at five months old."

The whole thing is a matter of pounds, shillings, and pence. For the local market there is no actual demand for capons, as they will fetch no more than well-fed cockerels, while all the London reports testify to the same end.

Appended are the results of the capon shipment, from the *Daily Telegraph* of June 20:—

Case.	Weight.	London Price.	Net Return.
	lb.	s. d.	s d.
18—Black Orpingtons	6	4 0	3 4½
19— ,, ...	4½	3 0	2 4½
29—Wyandottes	5	3 3	2 7½
35—White Leghorns	4	2 6	1 10½
36— ,, ...	3¼	2 3	1 7½
37— ,, ...	4¾	2 6	1 10½
38— ,, ...	4½	2 4	1 9
39— ,, ...	4	2 3	1 7½
40— ,, ...	4	2 3	1 7½
41— ,, ...	2¾	1 9	1 1½

From the above it will be seen that some of the lighter-weight Leghorns returned more than others three-quarters of a pound heavier. This is attributable to the appearance of the birds, many of the latter having combs equal in size to adults of that breed, and suggesting that they had not been caponised, but as the scar of such was visible it has to be concluded that they were what is known as slips—*i.e.*, the operation not being successful. In conclusion, it should be stated that, whether as cockerels or capons, Leghorns, if presented in the usual way to the depôt by exporters, would be rejected as not suitable for London.

Those Nitrogen Germs.

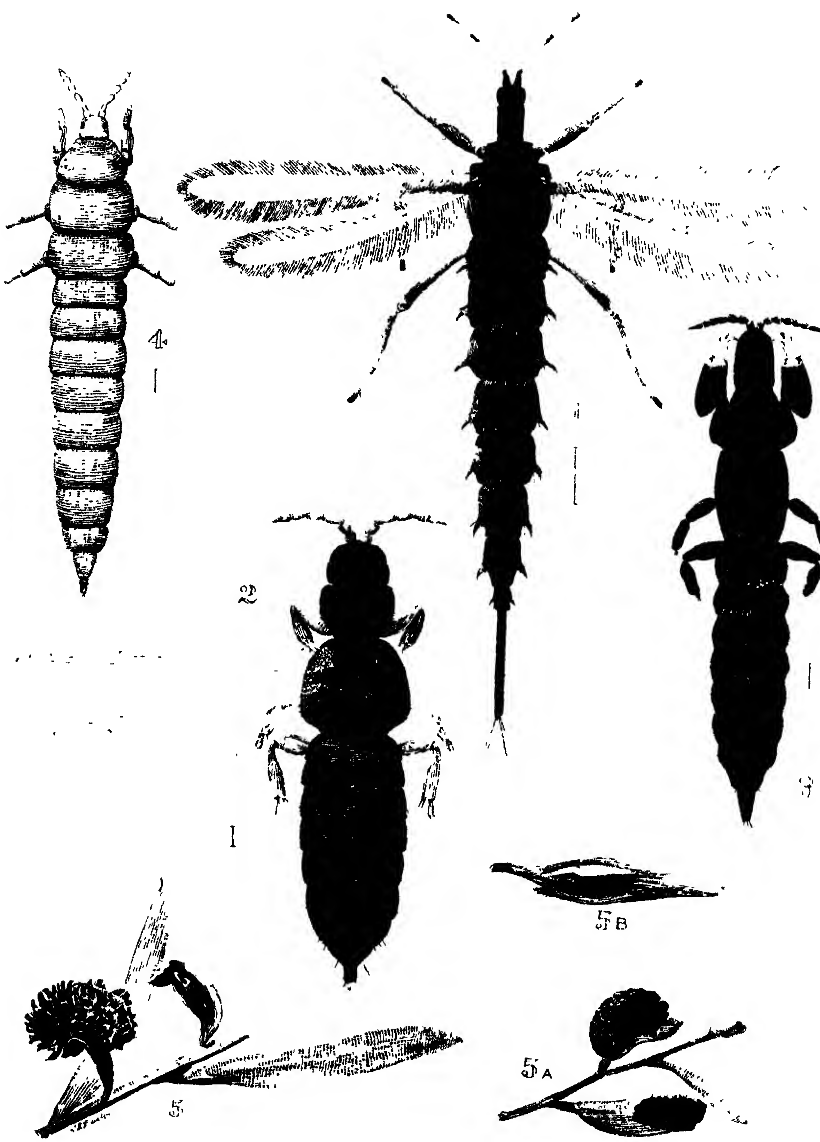
"The United States Department of Agriculture issues a special circular saying that the extravagant and misleading claims contained in some of the advertising matter now appearing in regard to inoculating material for legumes make it necessary again to call attention to the limitations of the value of inoculation. Summarised from Department bulletins, they may be stated as follows:—

"No beneficial results can be expected for a particular crop if the bacteria for that crop are already present in the soil.

"But little, if any, benefit can be expected from the use of these bacteria if the ground is decidedly in need of other fertilisers, such as phosphates, potash, or lime.

"But little, if any, benefit can be expected from inoculation if the soil is already rich in nitrogen.

"A recent examination of samples of cultures for inoculating legumes obtained through various seed firms throughout the United States indicates that there has been a slight improvement in the general character of these cultures."—*Pacific Rural Press.*



THRIPS OR BLACK FLY (THYSANOPTERA).

1. *Idolothrips spectrum* (*Giant Thrips*).
2. *Thrips tabaci* (*Onion Thrips*).
3. *Kladothrips rugosus* (*Gall Thrips*)
4. *Kladothrips rugosus* (*Larva*).
5, 5A, 5B. *Kladothrips rugosus* (*Galls in various stages*).

Thrips or Black Fly (*Thysanoptera*).

WALTER W. FROGGATT, F.L.S.,
Government Entomologist.

THE insects belonging to this group are well-known pests to the farmer and gardener under the names of "Black Fly," "Thrip," or "Feather Wings." *Thrips* is a Latin name derived from the Greek word, meaning a wood-louse. They increase with such marvellous rapidity in sheltered situations in gardens, bush, and green-houses that under suitable conditions they multiply as quickly as aphis, attacking the surface of the leaves and causing them to become discoloured and withered, so that the infested shrub often looks as if it had been singed or frost-bitten.

Their presence is generally first detected from this browning of the foliage instead of the healthy green tint. This damage, at first overlooked, is often put down to mildew or fungus as it becomes more pronounced. They do not actually eat the epidermis, but prick through the skin and suck up the sap directly under the epidermis, for the mouth of a thrips is a very complicated structure, furnished with more or less distinct jaws on either side of a tubular cone-shaped beak that has puzzled most of the entomologists who have turned their attention to these insects.

The entomologists have, in consequence of their distinct peculiarities which separate them from all the other insects, placed them in an order by themselves, calling them *Thysanoptera*, "tassel wings," in allusion to the slender veinless wings fringed with cilia-like hairs, possessed by most of the typical forms, though there are a number of wingless species. They are also often called *Physapoda*, "bladder feet," from the rounded form of their simple tursi.

Many of the smaller species are world-wide in their range, for both in the larval and adult state they are very easily introduced into new countries on cultivated plants. Several common European species have been acclimatised thus for many years in Australian gardens, but from their insignificant size and retiring habits few entomologists have noted them in this country. There are some records of wholesale destruction of crops in other places. Westwood states that in 1805 one-third of the whole crop of wheat in Piedmont was destroyed by thrips, and in the same season many fields in England suffered severely. This was probably the species described by Haliday under the name of *Thrips cerealium*, which lodges behind the internal valve of the corella and embryo grain, causing it to shrink and finally shrivel up to nothing. This pest also attacks the wheat stalks above the knots, where it does further damage

under the shelter of the leaf sheath. Thrips were at first supposed to be the cause of the potato epidemic in 1846, but the researches of Curtis proved that though they did considerable damage to the foliage, they were not the cause of the blight. Curtis has recorded other species swarming over melons and cucumbers in England and destroying their leaves. *Thrips adonidum* infests the leaves of the poppy in India, frequently injuring all the foliage and even the seed. The natives of Northern India call them, as well as several other small insects, "Lhi." In the United States, *Thrips striatus* has been described by Osborn as a very serious pest to onion plants, and Hinds has found this species on five different kinds of grass. Fitch states that *Coleothrips tritici* is the species that does so much damage to the wheat crops in some parts of North America.

An obscure disease on the Cacao palms in the West Indies was traced by Maxwell-Lefroy to the presence of an undetermined species of these pests upon the young pods and leaves, and it has been recently claimed that the carnation disease, known as "Stigmonose," is induced, if not directly caused, by the punctures upon the leaves made by these and other minute insects, and Cobb has suggested that the same action may be the primary cause of shot-hole fungus of the apricot. However, though the cause and effect of insect and fungus are often closely related, a simple injury like a puncture is not likely to cause further damage, unless the fungus spores afterwards gain a foothold on the damaged tissue.

Some species, like the rose thrips, feed upon the pollen of flowers, and when numerous thus destroy the production of fertile seeds; others are believed to be carnivorous, feeding upon aphids and other soft-bodied insects.

When they appear in large numbers, blown or flying from their feeding grounds, and settle upon one's face and hands, it has been noticed that they produce a very unpleasant itching of the skin, and pain in the eyes, presumably from the fine ciliæ fringing the wings becoming detached and sticking into the skin.

Australia is remarkable for possessing the largest-known thrips in the world-wide *Idolothrips spectrum*, which measures up to ½ an inch in length, whereas most species are microscopic. We also have a number of very interesting native species that produce galls upon the leaves or leaf buds of the trees they infest, a peculiarity that has only been recorded from Java outside this country. As most of our gall-producing thrips are found inhabiting the dry interior, it appears to be a remarkable instance of adaption to their surroundings, for any of the ordinary forms that feed upon the surface of the leaves could not exist if exposed to the scorching sun and burning hot winds of summer in this region; but safe under the protective cover of a thick wooden gall, they can defy the fiercest sun and hot wind, and multiply with impunity.

The thrip galls show some very interesting points in the study of gall formation, as they illustrate both the primitive simple curling of the infested leaf, caused by the larvæ attacking the outer edge, and the more specialised aborting of a leaf-bud into thin biscuit-like tissue, like the

wrinkled bud-galls of *Callestemon*. In the bubble galls of the Acacias we have a gall caused by the punctures of a female thrip upon one side of the leaf, forming a scar, which produces a stout-shelled gall, sometimes absorbing the whole of the leaf tissue in its construction. These galls, often as large as a small marble, cover the infested trees, and when cut across are found to be completely packed larvæ, pupæ, and cast skins. In the course of time an opening appears in the original scar, through which the adults can gain admittance to the outside world. I have had specimens sent me from the interior of Western Australia that on their arrival in Sydney nearly a month later, were full of active living thrips.

Thrips were first described by De Geer in 1744, who named them *Physapaus*, but Linnæus, in his great work "Systema Nuturæ," placed the four species then known to him in the genus *Thrips*, ignoring De Geer's name. From that time thrips were noticed by many writers, but the first systematic writer of English species was A. H. Haliday, who described a number of species in several papers in the "Entomological Magazine," 1836-37—one entitled "An Epitome of the British Genera in the Order Thysanoptera," with indications of a few of the species, and a second, "Additional Notes on the Order Thysanoptera." After Haliday's death, Walker, when publishing his "List of Specimens of Homoptera in the Collections of the British Museum," included in it Haliday's work (Part IV, Physapoda), where new species were described, among them our giant thrips (*Idolothrips spectrum*).

In 1895, the Bohemian entomologist, Dr. Uzel, issued his "Monograph of the Order Thysanoptera," illustrated with ten plates of figures of species and their anatomy. This work is, unfortunately, written for the greater part in his native language, so that its value to an ordinary English entomologist is somewhat discounted. The work of economic entomologists, in dealing with the habits and life histories of destructive insects, led to a number of observations being made upon the structure of the mouth parts of these tiny creatures, which differ from all other kinds of insects, being a sort of compound of both a biting and a sucking mouth; for while the cone-shaped mouth is a sucking apparatus, traces of well developed jaws are to be found in most species. Among the latter-day writers, Jordan has done a great deal in defining these mouth parts (Anatomie and Biologie der Physapoda, 1888). Nothing has been done in regard to the study of Australian thrips with the exception of Haliday's description noticed, and my account of the habits and life history of his species ("Proceedings of the Linnean Society of New South Wales, 1904"); Sharp's notes on gall-making species furnished to him by the writer (Cambridge Natural History, Insecta, Part II); and a description of a species found upon an Acacia in South Australia, and described by Dr. Uzel after Mr. Tepper, who sent him the specimens (Phlocothrips tepperi, 1905). I have, however, in hand, a large amount of material containing a number of very remarkable Australian species, which will be shortly published in the "Proceedings of the Linnean Society of New South Wales."

The thrips lay their eggs upon their food-plant, from which develop tiny little transparent elongated maggot-like creatures, with three pairs of short legs, short-jointed antennæ, eyes, and the mouth hidden from above turned down under the head, so that the tip of the cone-shaped process rests between the base of the fore legs. These larvæ undergo an incomplete metamorphosis, casting their skins at intervals, gradually changing colour until at the final moult they appear black or reddish-brown in general tint, with, in most species, two pairs of well developed wings folded down the centre of the back. These wings are slender or oar-shaped in form, and usually very delicately fringed along the inner margin and round the tips with fine hair-like filaments, giving them a beautiful feather-like appearance when viewed through a lens, for it must be always remembered that the bulk of our thrips are tiny little microscopic insects, often $\frac{1}{24}$ of an inch in length.

The Giant Thrips (*Idolothrips spectrum*, Haliday).

This curious species is common in the scrub about Sydney in the early summer months, frequenting the leaves upon the dead branches of fallen eucalypts, and if such a branch is raised from the ground and shaken, hundreds of these insects will drop out and run about over the ground with their tubular tails turned upward just like some of the little *staphylinid*, or rove beetles. It has a very wide range from Tasmania to Southern Queensland. The original specimens were collected by Charles Darwin when the "Beagle" visited Australia on her memorable voyage in 1836. These specimens subsequently came into the hands of Haliday, who was engaged in a classification of these insects in the British Museum; but, though he probably described them at the time, it was not until sixteen years after that these descriptions were published by Walker.

Haliday made three species out of the material in his possession; but a careful examination of an unlimited supply of specimens satisfied me that he had described both sexes as distinct species, and named a variable but common variety.

The female lays her oval horny eggs in clusters containing from 50 to 250, in irregular rows, but attached to each other on the sides, so that they can be detached in one mass. The baby larvæ are semi-transparent little creatures, which go through a number of moults, changing both in form and colour several times in the development, and going through an imperfect pupal stage before they finally moult into the perfect winged thrips.

The adult insect varies in size from $\frac{1}{8}$ to $\frac{1}{2}$ an inch in length, and is of a general black tint, with brownish markings on the antennæ and rich, red blotches upon the legs, thorax, and sides of the abdominal segments. It has long slender antennæ, slightly clubbed at the tips of the apical joints; the head very long, cylindrical, with the prothorax irregularly hexagonal; the body is elongate, tapering to the extremity, which terminates in a long, slender tube fringed with long bristles; the sides of

the abdominal segments produced into a stout tooth, and the long, slender fringed wings folded down the back.

It is difficult to say what these insects can find to feed upon among the dead, dry leaves of the gum trees; but when fresh foliage and flowers were placed in the jars in which they were confined, they never left their natural shelter to come upon them.

The baby larvæ are very much infested by a curious little mite that lived among the egg clusters, and clambered into the backs of the larval thrips soon after they emerged from the eggs; but though as many as five or six often infested a single larvæ, it did not seem to incommode them very much.

Black Fly (*Heliothrips hæmorrhoidalis*, Bouché).

This is one of the commonest cosmopolitan species of thrips found in gardens upon all kinds of shrubs, in hot-houses, and I have found it damaging the fern fronds and leaves of eucalypts in the bush a considerable distance from any garden. Bouché described it in 1883 as a native of Germany, where it is known as "Black Fly." Hinds, redescribing it in the "Proceedings of the National Museum" (Smithsonian Institution, 1902), states that the male is still unknown. Hinds says: "In his original description, Bouché states that he believes that the native land of this species in America. In both countries, however, it has been found almost entirely confined to green-houses, and feeding upon green-house plants." Packard says it is one of the greatest pests in hot-houses; and Cook says much the same about it in Michigan. I have noted it in our Insectarium at the Hawkesbury Agricultural College infesting every plant in the green-house.

It measures $\frac{1}{16}$ of an inch in length, and to the ordinary observer appears to be quite black, with pale whitish wings folded down the centre of the back; but careful examination shows that the head and thorax have a brownish tint, and viewed from the underside the abdomen is yellowish-brown. The head is very short, with prominent eyes; three ocelli; mouth cone, short, and blunt, with the antennæ composed of eight irregular joints; the thorax and body short, the latter pointed at the tip; the wings finely feathered; the legs short; the whole insect in a stout, very rugose integument, giving it a coarse, roughened appearance.

The larvæ are semi-transparent little creatures that hide on the under surface of the leaves, crawling about with a globule of liquid attached to the tip of the anus.

The Onion Thrips (*Thrips tabaci*, Lindeman).

We have on several occasions had samples of onions growing in the neighbourhood of Sydney sent to the Department for examination, infested with immature thrips that will probably turn out to be identical with this cosmopolitan species. The larvæ swarmed in the top of the onions, and caused all the green leaves to become mottled and bleached. In America, the effect of this thrips upon onions is known as "White Blast," on account of this premature discoloration of the tops.

It measures about $\frac{1}{25}$ of an inch in length, and is of a somewhat more elongate form than the "black fly"; is of a general pale-yellow colour, with the eyes and tips of the proboscis black. The males are smaller than the females, and the inner edges of the wings are fringed with long dark hairs.

The onion thrips is a well-known pest in other parts of the world, and was described by Lindeman as a pest upon tobacco in Russia in 1888; in Germany it has been recorded upon leeks. In the United States it has been a very serious pest for many years, and is one of the most serious pests in some seasons that the onion-growers have to fight. Nearly all the economic entomologists in the different States have written on the subject of dealing with this pest, that ranges from Connecticut to Florida, where it has been recorded upon over fifty different plants, but is commercially a pest upon cabbages and onions. Webster ("The Onion Thrips," Journal Hort. Journal, Columbus, 1901), considers that good cultivation, and the clearing away of all grass and weeds about the onion beds, is one of the most important preventives. He also urges the destruction by burning of all refuse on the land after the crop has been harvested. Whale-oil soap is the chief spray used to destroy them on the infested onions.

The Palm Thrips (*Parthenothrips dracænæ*, Heeger).

The thrips was described by Heeger in Austria in 1854. It has a wide range over the northern half of Europe, and is well known in the northern parts of the United States. It is limited in its range of food-plants, having been originally described by Heeger on *Dracæna*, and recorded by Hinds on *Kentia* and *Ficus*. I have taken it on one occasion in a plant nursery near Sydney upon the foliage of the Norfolk Island Palm.

It is a dull yellowish-brown insect, with the head, thorax, and wings covered with reticulated ridges, giving it a rugose appearance. The very distinctive barred wings make it easily recognisable from all other species.

The Rose Thrips (*Thrips*, sp.).

The tiny, little, rusty red thrips that does so much damage to the early roses in our gardens, and always seems to have a marked preference for white or light-coloured roses, is, I believe, identical with the onion thrips (*Thrips tabaci*). Last year, in the suburbs of Sydney, in consequence of the long spell of dry weather and late winter, climatic conditions that seem to be suitable to this pest, all the early roses were infested with countless numbers of these little creatures, that caused the roses to fall to pieces before they were properly opened.

Remedies.

From their retiring habits, and the rapidity of their reproduction, thrips, like aphids, are seldom noticed until they have seriously damaged the infested plant. As they usually secrete themselves on the under surface of the foliage, they are difficult to get at with a sprayer. They prefer

dry sheltered spots, and where the wind has full play and the plants get a good supply of water they seldom appear to do any damage.

Fumigation with tobacco in green-houses is the only successful treatment in England and America, but it requires a stronger dose to kill them than it does to destroy aphids. Where the plants are in pots and small, they can be taken and dipped upside down in kerosene emulsion, or soap and tobacco waste.

Hardy shrubs can be fumigated in the open with hydrocyanic acid gas, in the same manner that fruit-trees are treated for scale insects. With regard to the rose thrips, I found that, besides heavy spraying in the evening with the hose nozzle, that the best thing was to go round early in the morning with a bucket half full of water, to which had been added ¼ of a pint of kerosene, and pluck off all the infested roses and press them in under the oil. If the roses are only thrown into a bucket of water, numbers of the insects come to the surface and manage to fly away.

NOTE.—The gall-making species shown on the plate as a typical Australian form of thrips was obtained at Tamworth, upon the foliage of a short-leaved acacia. It will not fit into any of the known genera, so I propose to call it *Kladothrips rugosus*. A technical description will shortly be published in the "Proceedings of the Linnean Society of New South Wales." It is black, with the antennæ, tibiæ, meso- and meta-thorax, and first segment of the abdomen yellow; the head rounded, twice as long as broad, with seven-jointed antennæ, two ocelli, and rounded eyes; thighs of the forelegs much swollen, with two short claws at the apex of the tibiæ; wings well developed, and abdomen slender, terminating in a tubular process; length, $\frac{1}{12}$ of an inch.

Resumé of the Operations at the State Experimental Farms for the year.

Hawkesbury Agricultural College Experimental Farm.

H. W. POTTS, Principal.

Rainfall.

1905.	inches.	1906.	inches.
July	·195	January	2·310
August	·110	February	·712
September	1·345	March	3·305
October	1·095	April	·150
November	1·812	May	1·645
December	4·740	June	·610

Total for year, 1st July, 1905, to 30th June, 1906, 18·029.
Average for twenty-five years, 31·367.

The meteorological record discloses the severe weather conditions we have laboured under for the past season; and had it not been for the 134 points of rain falling in September, our position, in so far as the crop and grass were concerned, would have been disastrous. Mr. Cobb, Farm Foreman, reports that the hay crops were light. From 210 acres of wheat and 161 acres of Algerian oats we harvested 200 tons of hay; from 45 acres of rye we recovered a straw crop with very light grain.

The absence of sufficient moisture affected the potato crop, from which 3 tons per acre of Bliss's Triumph were obtained.

The fall of 5 inches in December allowed the planting of maize for ensilage and green fodder. This has successfully grown, and the results were mainly due to the conservation of moisture by persistent cultivation throughout the very warm part of the summer. In addition to providing green feed for the dairy cattle and pigs during the autumn, 600 tons of ensilage were made.

The main crop of maize for grain, consisting of 60 acres on the River Farm, was light, owing to the absence of rainfall. The crop yielded 40 bushels to the acre. On the College Farm, 60 acres were harvested, which gave a return of only 15 bushels to the acre. This was cut with the McCormick Corn Harvester and shredded for stover. At the River Farm the stalks were cut down with the Mitchell Roller and Cutter and ploughed in. During the operation of ploughing in we got the best work from Messrs. Ritchie Bros.' Corn Plough, which buried the stalks completely.

This season we have sown 185 acres of wheat for hay, in which the following varieties were used:—

Bobs	White Velvet
White Lammas	Australian Talavera
John Brown	Tarragon.

Sixty acres of Algerian oats were also sown, and 20 acres each of Cape barley, for green feed and grain respectively. In addition, 4½ acres of Emerald rye were sown for grain purposes.

The rainfall for the half-year being only 8 inches, this, combined with continuous westerly winds, is checking growth, and the crops do not look promising.

Paspalum dilatatum.— 70 acres of this excellent grass were sown during the spring in two paddocks, but the rainfall was insufficient to germinate the greater portion.

Cowpeas.—50 acres were sown with this legume as a rotation and for green manuring. The results were highly satisfactory. During the hottest months of summer we had a nutritious and succulent crop for grazing cattle and young horses.

Rape and Turnips.—70 acres sown during the early autumn as rotation crops and for green manuring, have not proved as successful as in previous years. These are being fed off, and will fertilise the soil for early maize crops.

A considerable area of land is at present being worked for early summer crops to enable us to provide for feed, seeing the prospects of our winter crops are poor.

Field Experiments.

The scope of experimental work, conducted by Mr. Geo. Marks, Instructor of Agriculture, has been extended, and increased interest added by trials of maize, potatoes, and mangolds which have been carried out on the rich alluvial soil of the River Farm.

The conditions for successful experimental work during the season were of the most adverse character. Frosts prevailed until the first week in November. These were succeeded by a succession of dry, parching westerly winds and long periods of hot weather.

Potatoes.

The trials represented experiments with varieties and fertilisers on poor soil of the College and the rich soil of the River Farm. A full report has already appeared in the *Agricultural Gazette* (July, 1906, page 671).

Maize.

During the year sixty varieties of maize were received from the St. Louis Exhibition and planted. A quantity of the seed was badly affected with weevil; and with the bad weather, 75 per cent. of it did not germinate, notwithstanding that several sowings were made. The following grew, and a small quantity of seed was saved for this season's sowing:—

Angel of Midnight	Golden Surprise
St. Louis Champion Red	Michigan 16-row Dent
Brick-red Dent	Johnson's Blood-red Dent
Madison Yellow Dent	Gregory Golden Dent
Zebra Dent	Johnston's County White Dent
Chicago Beauty	Rogers' Red Flint
Long White Flint	Johnson's Flesh Colour.

A trial was also made of a number of our own varieties. The following gave the best returns:—

Pride of the North	Red Hogan
Golden King	Hickory King
Iowa Silver Mine	Riley's Favourite.

A fertiliser trial was also made, but the yields, due to the use of the manures, were rather unsatisfactory, and it was evident that the crop did not get the benefit of the manures supplied.

The trials of millets were interfered with by sparrows, which devoured the bulk of the seed. White French and Hungarian gave the best results.

Cowpeas.

Twenty varieties of cowpeas were planted, mainly with the object of raising sufficient seed for sowing on extended areas. Of these, the following are among the best:—

Black	Great Northern Prolific
Iron	Southdown
Chinese	Warren's Extra Early.
Red Ripper	

Linseed.

Two acres were sown with linseed for producing seed and fibre. One was sown at the rate of 1 bushel to the acre, whilst for fibre 2 bushels to the acre were used. Both lots germinated well, but the hot, dry winds checked the growth, which did not reach 6 inches high, and ended in complete failure. Linseed does not appear to be a suitable crop for growing in poor soil at this farm.

Autumn Crops.

A trial of ten varieties of turnips and Swedes was made; also a cultivation trial of the same crop was harvested, the results of which have already been published in the *Gazette* (December, 1905, page 1215). White Pomeranian gave the heaviest yield.

The wheat and oats were badly affected by the drought, and as there was a shortage of feed and small prospects of seed being well developed, the bulk of these were cut for hay, yielding about 15 cwt. per acre.

Four hundred strains of the late Mr. Farrer's cross-bred wheats were grown and harvested, selections being made of only those plants which showed freedom from bunt and rust. Upwards of 500 strains have been sown again this autumn for the same purpose.

The Argentine varieties of oats have had very unfavourable conditions, so that a fair report could not be faithfully made at this stage. A quantity of seed has been saved and sown.

Barleys and ryes, though planted, made poor growth and gave light yields.

Grasses.

Rhodes grass and Texas Blue grass have held their own as drought-resisters, and large quantities of roots of these grasses have been sent to all parts of the State. Most of the native grasses have been killed during the summer, but arrangements have been made to have water laid on to the plots, and it is hoped that most of these grasses will be kept alive during the dry, hot weather.

Economic Plants.

In addition to the main crops grown for experimental purposes, a large number of economic plants have been grown for teaching purposes. These embrace—

Cotton	Mustard
Tobacco (ten varieties)	Sunflowers
Sweet Potatoes (five varieties)	Hemp
Peanuts	New Zealand Flax
Clovers	Artichokes
Lucerne	Salt-bushes
Lupins	Arrowroot
Beans	Castor-oil Plants.
Onions (eight varieties)	

Co-operative Experiment.

During the year a manure experiment with maize was arranged, and five old boys of the College undertook to carry it out; but the bad season seriously interfered with the results, which in several instances ended in failure.

Dairy Section.

The breeds of cattle giving the best returns on our low-class land are the Ayrshires, Red Poll, and Dexter-Kerry.

Owing to the exceptionally dry season, the value of ensilage as a basis for a balanced ration has again been unmistakably demonstrated. We have conserved about 600 tons in the tub-silos, pits, and stack. It is the only means available here, during the periods of scarcity, of maintaining stall-feeding and keeping the cows in full milk.

The effect of dry weather was very pronounced in the paspalum paddocks. It is evident the *Paspalum dilatatum* will not withstand drought conditions for grazing purposes. In this regard, it was noted that Rhodes grass was green and fresh throughout the summer, and afforded a sharp contrast, but the Rhodes grass is not so succulent or relishable.

The Piggery.

In the piggery a marked improvement has been effected by the importation of pure-bred stock direct from England. These include two Berkshire boars, one each Large Yorkshire, Middle Yorkshire, Large Black and Tamworth, with sows of the Large Yorkshire, Middle Yorkshire, and Tamworth breeds. These arrived a few weeks ago, in excellent condition. They were very carefully selected from the leading strains of blood in England by Mr. W. H. Clarke, of the Agent-General's Office, who has a good knowledge of the types we require in this State.

A number of sows have been retained, bred from the previous importations of pure stock. With this basis, we will be enabled to distribute the finest of stock to the farmers, prominent for their quality, size, vigour, early maturing, and fattening propensities.

The old boars have been dispensed with, and their places in the stud occupied by the recent importations.

The Berkshire breed continued to maintain the lead amongst our farmers. Of late, a considerable demand has sprung up for Large Blacks. This breed has acclimatised well, and retains its chief characteristics for prolificacy, hardiness, and the production of well-flavoured bacon.

Feeding on the paddock system was practised during the spring, autumn, and winter, the principal growths being couch, paspalum, rape, lucerne, and cowpeas. For this purpose, another paddock has been suitably fenced and watered. In addition, the usual farm crops have been made available for the piggery from time to time to demonstrate their feeding value for pork. These were chiefly maize, sorghums, millets, pumpkins, squashes, and artichokes. The residues of other crops were also utilised on the piggery, to show the usefulness of the pig in practically acting as the farm scavenger. Such residues come from main crops of potatoes, mangolds, beets, turnips, &c.

WAGGA EXPERIMENTAL FARM.

G. M. McKEOWN, Manager.

Rainfall.

Rainfall from 1st July, 1905, to 30th June, 1906.

1905.	Inches.	1906.	Inches.
July	2·73	January	nil.
August	1·06	February	1·21
September	1·62	March	4·17
October	3·35	April	2·20
November	nil.	May	3·33
December	·95	June	2·26
	9·71		13·17

Total for the year .. 22·88 inches.

Rainfall for the previous years, January to December.

	Inches.		Inches.
1891	26·35	1899	15·96
1892	21·31	1900	24·30
1893	25·66	1901	17·93
1894	33·99	1902	11·97
1895	17·08	1903	19·41
1896	20·31	1904	16·15
1897	14·98	1905	18·94
1898	14·33		

Stock.

Sheep.

There are now on the farm a total of 725 sheep, which is a much less number than we can profitably carry.

The breeds consist of Lincoln, Border-Leicester, and Shropshire rams, and Shropshire-Merino and Lincoln-Merino ewes.

Four hundred and seventy-nine lambs were raised from 503 Lincoln-Merino ewes by Shropshire rams; these were sold on the farm at the record price for the district for the season.

The following crosses have been made during the past season, and lambing is now proceeding (June):—

Shropshire rams on Lincoln-Merino ewes.
Shropshire rams on Merino ewes.
Lincoln rams on Merino ewes.
Border-Leicester rams on Merino ewes.
Border-Leicester rams on Lincoln-Merino ewes.

A small flock of pure Shropshires is kept, and the demand for rams is far in excess of the available supply.

Cattle.

The milking cows will shortly be increased by a number of heifers which are coming to a profitable age. The establishment of a complete dairy for the further instruction of students is very desirable, especially in view of the contemplated increase in the number of students.

The average yield of milk from twenty-three cows from 1st January to 31st December, 1905, was 5,216 lb. The results of the year's work shows that the herd has improved in milking qualities as well as numbers.

Horses.

The number of horses has been increased by the birth of five foals by the Suffolk Punch stallion Commander.

It was hoped that we should have been able to make a number of demonstrations of the value of the Suffolk sire on mares of various types, but the necessary stock has not been available.

The young horses bred on the farm are all doing excellent work. The aged mares which, being past work, were utilised for breeding purposes, have demonstrated their value in this department by rearing young stock worth respectively £115, £110, £75. Two mares still at work have reared young stock worth £145. All available mares were stinted last season.

Ensilage.

For this purpose 45 acres were sown with Skinless barley and peas, and a similar area with sorghum. The former paddock yielded a very satisfactory crop which was duly conserved in stacks, portion of which has been fed to dairy stock, and portion carried forward for future use.

Forty-five acres of Skinless barley and peas, sown in March last, is now being cut and stacked for use when required. Fifty acres of sorghum also was sown in October last, and the crop which, as is usual, was a light one has been stacked.

Wheat for Hay.

One hundred and seventy-three acres were sown for hay production, the variety being Zealand.

The yield obtained from a 73 acre portion of this area, weighed on the weighbridge, was 233 tons; the remaining 100 acres yielded about 300 tons, measured on the basis of the bridge weights.

At present we have stacked on the farm about 800 tons wheaten hay, a portion of which it is intended to sell as soon as teams can be obtained for its conveyance to the railway. In addition to the above, we hold about 800 tons of wheaten and barley straw, saved from the threshing machines.

Wheat.

The following yields were obtained:—

	Per acre. bus.	lb.		Per acre. bus.	lb.
Bobs (unmanured)	9	36	Jade	20	57
,, (manured)	21	4	Field Marshal	25	10
Zealand	21	1	Cumberland	28	0
John Brown	22	0	Velvet Don	15	41
Farmer's Friend	22	40	Rymer	21	49
Plover	20	6	Federation	21	51
Jonathan	17	38	Schneider	13	7
Australian Talavera	17	50	Cretan (Macaroni)	17	0
Marshall's No. 3	20	31	Beloturka (Macaroni)...	16	16
White Essex	20	7	Kubanka (Macaroni)	15	54
White Lammas	17	46	Farrer's Durum (Macaroni)	17	0
Dart's Imperial	28	0			
Tarragon	21	49			

Barley.

Varieties were sown in an area comprising about 80 acres, 50 acres of which were harvested for grain. The following varieties, viz., Albert and Zero, proved too late or otherwise unsuitable for our conditions, therefore they were cut for silage. The following grain yields were obtained:—

	Per acre bus.	lb.		Per acre. bus.	lb.
Invincible	43	5	Skinless	29	8
Hallett's Chevalier	40	34	Eclipse	27	8
Golden Grain	36	10	Brewer's Favourite	23	13
Standwell	29	24	Maltster	21	36

All the above were manured with superphosphate only.

The following yields were obtained from areas sown for the purpose of comparing manures, the variety of barley being Kinver Chevalier:—

	Per acre. bus.	lb.
Unmanured	31	37
Superphosphate (with potash)	40	37
Superphosphate (without potash)	36	23

Oats.

A full report appeared in the *Gazette* for April of this year.

Bathurst Experimental Farm.

R. W. PEACOCK, Manager.

Rainfall.

From 1st January, 1905, to 31st December, 1905:—

	inches.		inches.
January	·86	July	1·67
February	1·54	August	·81
March	1·31	September	1·39
April	2·20	October	2·84
May	3·44	November	·35
June	1·73	December	·43
		Total	18·57

From 1st January, 1906, to 30th June, 1906:—

	inches.		inches.
January	·76	April	·59
February	2·55	May	1·43
March	3·77	June	2·35
		Total	11·45

The operations were carried out throughout the year under comparatively adverse conditions. The rainfall for the twelve months, from 1st January, 1905, to 31st December, 1905, as will be seen from the above table, was 18·57 inches, or over 5 inches below the average. This, following on a shortage of 6 inches below the average for 1904, proved inadequate.

Notwithstanding this shortage, very satisfactory results were obtained from the winter cereal crops. The distribution of the rainfall prejudicially affected the summer crops. November and December of 1905 and January of 1906 proved very dry, and these, owing to the unusually late spring, were equivalent to October, November, and December of ordinary seasons. The month of October proved wintery, the average of the minimum temperatures being 33 degrees F. This unseasonable weather not only retarded growth, but interfered considerably with the fruit crop, and retarded the sowing of all spring crops by about three weeks. This was followed by a prolonged autumn, the month of June, 1906, being one of the mildest ever experienced in the district, the average minimum temperature being 37·7 degrees F.

Crops.

Wheat.

Notwithstanding the light rainfall and other unfavourable conditions, some very satisfactory yields were obtained, due principally to the system

of rotation and cultivation followed, such allowing of the building-up of the wheat lands and the retention of soil moisture. Eighty-two and nine-tenth acres were harvested, they being sown in connection with the various rotation, manurial, and variety test experiments carried out throughout the year.

The average yield per acre, excluding paddock No. 20, which was eaten off twice by sheep, was 22 bushels 27 lb. The highest yield was 37½ bushels per acre, being obtained from Federation, grown in a paddock previously under rape. Eleven varieties were grown in large areas for comparative trials and pure seed for farmers. (For detailed report see *Agricultural Gazette*, April, 1906, page 367.)

The demand for pure seeds is considerable, and the supplies have not been equal to it, especially as regards Federation.

The manure experiments with wheats, extending over several years, will be tabulated, and the results published in the *Gazette*.

The question of rotation in connection with wheat-growing is receiving considerable attention, the principal crops used being rape, tares, Scarlet clover, cowpeas, and lucerne. The disadvantages of growing wheat year after year upon the same soil were very apparent during the season.

The benefits from bare-fallowing are being demonstrated.

The advantages of comparatively early sowings were demonstrtaed throughout the past season, the falling-off in the rainfall at the close of the year being disastrous to the late-sown crops.

The production of pure seed of new varieties, and the improvement of old ones, was continued under the scheme formulated by the late Mr. Farrer.

Oats.

Five of the varieties most suitable to the district were grown in comparatively large areas for seed, they being Algerian, Red Rust-proof, Carter's Royal Cluster, Peerless, White Bonanza, and Potato.

Stud plots also were grown of other varieties to provide pure seed for future sowings. Twenty-nine varieties were under observation for selection.

Barleys.

The malting varieties—Standwell and Kinver Chevalier—were grown largely for pure seed. Twenty-five varieties of malting and feed barleys were tested, the most promising being selected for future trials.

Ryes.

Black Winter, White, and Emerald ryes were grown for pure seed, eight varieties being under observation altogether.

Maize.

Three varieties which had proved suitable for the district were grown largely for pure seed, they being Riley's Favourite, Golden Beauty, and

Hickory King. Every care was taken to keep them pure, and the improvement of varieties by careful selection and other means has been continued.

Sorghums.

Early Amber Cane, Planter's Friend, Sorghum saccharatum, and Imphi were grown for pure seed and stock-food.

Bacteria Culture Experiments.

An extensive experiment was carried out with the American nitrifying bacteria cultures for leguminous plants upon lucerne, tares, Scarlet clover, peas, Soy beans, and cowpeas.

In some plots the soil was inoculated by soil from portions of the farm in which similar crops did well for comparison. No effects of the cultures or inoculating soil were apparent.

Irrigation Area.

This area is devoted to growing fodder and other crops, such as lucerne, maize, potatoes, mangolds, onions, tomatoes, asparagus, rhubarb, and miscellaneous vegetables for the officers' and students' quarters.

Comparative tests of varieties are carried out with most of the crops, information about which will appear in the *Gazette* later.

Different methods of irrigating lucerne are demonstrated.

Stock.

Sheep.

Experiments in cross-breeding for the production of lambs suitable for export have been continued. Pens of four each—Shropshire-Merino, Lincoln-Merino, Border Leicester-Merino, English Leicester-Merino, and Southdown-Merino wethers—together with weaners of the same crosses and several pens of second-cross weaners and comebacks, were exhibited at the Sydney Sheep-breeders' Show, and proved a most valuable and instructive object-lesson much appreciated by producers of export lamb and mutton.

Cattle.

Kerrys, grade Jerseys, and other cows are kept to provide for the requirements of the quarters.

Pigs.

Pedigree Berkshires and Tamworths are kept, both breeds proving very suitable.

WOLLONGBAR EXPERIMENTAL FARM.

C. H. GORMAN, Manager.

THIS farm is situated at Wollongbar, 8 miles from Lismore, Richmond River. The climatic condition and soils there are generally typical of the important dairying districts of the semi-tropical portion of the State known as the North Coast.

Rainfall.

From 1st July, 1905, to 30th June, 1906.

	inches.		inches.
July	·17	January ..	4·74
August ..	·89	February ...	12·25
September ..	·12	March	10·84
October	3·39	April	1·46
November... ...	1·79	May ..	6·75
December.. .	2·56	June .	4·36

Total for year .. 49·32 inches.

The rainfall for corresponding periods in past years are as under:—

	inches.		inches.
1901-2	36·92	1903-4	75·02
1902-3 ..	30·12	1904-5 . .	45·81

Soil.

In this particular district we are situated somewhat differently to those in other parts, in that we have a soil which requires an immense amount of moisture, and if it is not forthcoming the results are anything but encouraging. Owing to the great depth and the porous nature of the soil, conservation of moisture is a matter of greater difficulty in this district than some others. At the same time, a district subject to heavy and continuous rain at times would become quite unfit for stock if the soil was not of a porous nature. During February and March of this year, in twenty-nine days rain fell registering 23·09 inches.

Dairy.

Up to now, little has been done to provide the necessary change in feed for the dairy cattle in this district. Grass grows with such freedom that many farmers cannot be brought to recognise the necessity of providing a variety of feed. It is now, however, being demonstrated that a change of feed is of great benefit to the cows.

Breeds.

Guernseys.

The direct result of the year's work goes to show that of all the breeds kept on this farm, Guernsey grades are in the lead. Though not the heaviest milkers, they are the most profitable on account of the richness of their milk. They have proved hardy, though at one period of the year, from January onward, it was thought that, owing to the number of cases of foot-rot, they could not be considered as robust as other breeds. This,

however, may be only a coincidence. We had five cases in all, three of them being of the breed referred to above. The Department is unable to meet the demand of local farmers for the lease of bulls of the breed. There is no doubt that the introduction of this breed has done an immense amount of good, and is responsible for the good class of cattle to be seen.

During the year several bulls have been sent from the Berry Stud Farm for local service, among them being the imported bull "Rose Prince."

The bulls now used here are:—Prince Vivid, by Rose Prince (imp.) *ex* Vivid (imp.); Prince Milford, by Rose Prince (imp.) *ex* Flaxy (imp.); Peter's Lad, by Peter (imp.) *ex* Souvenir (imp.).

All the young cows hereunder are by the imported Guernsey bull "Peter."

Name of Cow.	Dam.	Period of Milking.	Computed Yield in Commercial Butter.	Price per lb.	Return calculated as Cash at average price of Butter.
		Days.	lb.	d.	£ s. d.
Bud—	Blossom.				
1st calf	....	348	424·98	7·8	13 16 7
2nd calf	.. .. ..	252	219·37	9·7	8 18 9
3rd calf (still milking)	... .	81	144·10	...	......
Sapphire—	Gem.				
1st calf	....	300	317·40	8·4	11 2 5
2nd calf (still milking)	... . ..	318	376·22	..	......
Dulcie—	Dandy.				
1st calf	....	297	234·90	9·4	9 4 7
2nd calf (still milking)	....	174	189·74	..	.....
Violet—	Pansy.				
1st calf	... .	273	207·03	9·	7 15 11
2nd calf (still milking)	....	197	265·91	..	.....
Regina—	Queenie.				
1st calf	....	345	333·51	9·6	13 8 9
2nd calf (still milking)	....	120	141·35	...	......
Doreen—	Lady Dora.				
1st calf	... .	299	280·	9·2	10 16 6
2nd calf (still milking)	....	158	226·68	. .	.... .
Honeysuckle—	Honey.				
1st calf	....	311	263·48	8·9	9 16 11
2nd calf (still milking)	. . ..	272	267·17	...	......
Nancy—	Florence.				
1st calf (still milking)	....	196	203·41	...	.. ...
Caper—	Kate.				
1st calf (still milking)	....	128	198·07	...	......
Coral—	Ruby.				
1st calf	....	345	204·41	7·2	6 3 1
2nd calf	....	304	243·69	8·9	9 2 4
3rd calf (still milking)	....	245	217·79	...	......
*Pebble—	Bella.				
1st calf	....	551	455·	...	......

* This young cow has only just been dried off. Considerable trouble was experienced in getting her in calf.

The above list represents all the Guernsey grade cows at the farm; by this means the best and deepest milkers may be compared with the worst. These cows are all young, most of them on their second calf. It is reasonable to suppose that as they develop they will be more profitable.

Holsteins.

In this breed we have up to a certain point been very unfortunate, on account of the three cows representing the breed invariably throwing male stock, while what we want so much is female progeny for demonstration purposes. Among the grade stock, the calves have also been mostly males.

Holsteins do remarkably well, as the returns will show; but it is admitted that there must be an abundance of feed available, and that they are more suited to cheese than butter making, on account of the quantity of milk produced of low test. They have shown themselves to be of good constitution, and no more susceptible to disease than other breeds.

The imported cow "Margaretha" met with an accident, for which allowance must be made in her returns.

Name of Cow.	Period.	Commercial Butter.	No. of Days in Milk.	Average Price of Butter.	Computed Return.
		lb.		d.	£ s. d.
Margaretha (imp.)	1900	360·92	244	9·04	13 11 10
	1901	399·66	325	12·5	20 16 10
	1903	247·82	219	10·9	11 6 9
	1904	362·46	345	7·2	10 18 4
	1905-6	530·	468	......	....
Folkye II (imp.)	1900	312·28	306	9·09	11 16 6
	1901	243·33	276	11·94	12 2 1
	1903	300·20	263	10·76	13 9 2
	1903-4	270·86	252	6·75	7 12 4
	1904	336·08	356	9·1	12 14 10
	1905-6	.....	still milking.	....	....
Miss Douwe	1900	258·69	427	9·03	9 14 7
	1903	274·82	318	9·7	11 3 8
	1904	414·18	351	8·8	14 7 5
	1906	512·58	429	......	....
Boswe...	1906	225·15	185 still milking.	......	....

Shorthorns.

Under this heading, Milking Shorthorns (M.S.) branded cattle are also included, as well as pure Shorthorns. The latter are represented by the imported cow, "Lady Dora," now almost past her profitable period, and "Miss Knightly," a cow bred at Mooki Springs Station, but of a beef strain; also some young cows, the progeny of the imported cattle. In the M.S. class particulars of the yields of those animals by pure sires, our own importations, and local-grade dams are given. The comparison is of interest.

Name f Cow.	Year.	Commercial Butter.	No. of Days in Milk.	Average Price of Butter.	Computed Return.
		lb.		d.	£ s. d.
Lady Dora (by Paradox *ex* Deodora).	1900	416·13	265	8·35	14 9 6
	1901	346·11	275	10·7	15 9 9
	1902	296·44	367	11·02	13 12 9
	1904	251·39	332	8·49	8 17 10
	1905	193·64	235 still milking.	.....	... .
Miss Knightly	1902	274·381	294	10·77	12 6 3
	1903	299·67	283	7·13	8 18 0
	1904	295·46	276	8·28	10 3 10
	1905	323·59	289*	. ..	... .

In reviewing the returns from this cow, it is to be remembered that she is from a beef strain, but on the station where she was bred it is the rule to brand those of the beef herd that are good milkers, and in such manner improve the milking qualities by putting those cows to bulls from dams recognised as milkers.

Queen (by Cornish Boy (imp.) *ex* Champion.	1903	260·36	271	7·32	7 18 9
	1904	363·28	301	8·41	12 14 7
	1905	354·94	291 still milking.	. . ..	....
Tulip (by Cornish Boy *ex* Pansy).	1904	273·9	394	8·17	9 6 5
	1905	239·3	284	9·77	9 14 9
	1906	93·27	74 still milking.	... ..	... . .

* Only just dried off, consequently return in money value not yet computed. Milk yield, 6,517 lb.

Ayrshires.

The Ayrshire has always been a favourite breed, and has given good results from all points of view. Appended are a few particulars of the yields from the cows at this farm, and also of the returns from the progeny of the imported bull, "Daniel of Auchenbrain."

Name of Cow.	Period.	Commercial Butter.	No. of Days in Milk.	Average Price of Butter.	Computed Return.
		lb.		d.	£ s. d.
Judy (by Lord Raglan *ex* Judy of Barcheskie).	1901	180·99	224	11 3	8 10 5
	1903	259·63	298	9·58	10 7 3
	1904	314·04	270	8·62	11 5 7
	1905	191·72	263	9·6	7 14 4
	1906	70·66	88 still milking.	......	....
Pet Girl (by Hover of Southwick *ex* Topper II).	1902	492·63	537	12·2	25 0 10
	1904	451·7	503	8·4	15 16 6

This cow is difficult to get in calf, and is at present in the hands of the veterinary surgeon.

Eva (by Hover of Southwick *ex* Lady Emma).	1902	363·15	358	12·55	19 0 1
	1903	407·5	283	9·2	15 12 5
	1904	326·	298	7·6	10 8 3
	1905	81·19	131	8·69	2 18 9

This cow fell ill during this period, which put her off her milk.

Name of Cow.	Period.	Commercial Butter.	No. of Days in Milk.	Average Price of Butter.	Computed Return.
		lb.		d.	£ s. d.
	1906	33·6	39 still milking.	......	....
Dot (by Hover of Southwick *ex* Flirt).	1902	369·67	381	14·36	22 2 4
	1903	360·19	311	9·58	14 7 6
	1904	341 05	314	7·54	10 14 3
	1905	113·92	272	9·4	4 9 2
	Sick during part of the period.				
	1906	158·77	196 still milking.	......	....
Beauty II (by Hover of Southwick *ex* Beauty).	1902	393·3	414	11·85	19 8 4
	1903	253·7	273	6·75	7 2 8
	1905	264·46	270	9·52	10 9 9
	1906	173·95	120 still milking.	......	....
Daneva (by Daniel of Auchenbrain *ex* Eva).	1st calf	208·38	321	9·65	8 7 6
	2nd calf	95·86	92 still milking.	......	....
Juda (by Daniel of Auchenbrain *ex* Judy).	1st calf	226·88	337	9·65	9 2 5
	2nd calf	70·66	88 still milking.	......	....
Nada (by Daniel of Auchenbrain *ex* Dot).	1st calf	271·79	306	9·65	10 18 6
	2nd calf	85·74	67 still milking.	......	....

Other crosses are under trial, but, up to the present, definite results cannot be given. In making grades, pure sires are used in every case.

Bulls.

Throughout the year the farm has kept a full supply of bulls. Sales of bulls of all breeds have been made at fair prices.

The following is a list of bulls available for service, lease, or purchase:—

For Service or Lease.

Guernsey.—Rose Prince, Prince Vivid, Prince Milford.
Shorthorn.—Fanny's King.
Holstein.—Hollander.
Ayrshire.—Prince Royal, Dado.

For Sale.

Guernsey.—Prince Token.
Shorthorn.—Duke of Wollongbar, Margaret's King, Rose Boy, Royda.
Holstein.—Chairman, Hollandouwe.

The fact that students are taught to milk on the cows at this farm accounts in a measure for the returns not being better; cows will not give the best results when the milkers are constantly changed.

Ensilage.

This is a matter to which special reference may be made, because I have taken such a prominent part in advocating it throughout the whole of the Richmond and Clarence Rivers districts. Early in the year I went

round this district to give information on the subject, and to advise that later on instruction would be given in making, &c., and that all would be welcome at the farm during the process of making, and also when we were feeding it. Notwithstanding the apparent interest taken in the subject, I know of very few who have undertaken it as a stand-by. We have three stacks at the farm, one of which we are feeding now, and all interested are invited to come at any time in order to see for themselves that to have feed available in winter means no shrinkage in the milk supply, a matter of great importance to dairy-farmers.

About 110 tons of ensilage were made, and we have still about 85 tons available for use with which to carry on; this should last well into August or perhaps a little later, when a good supply of grass may be looked for.

There is also in course of erection a 100-ton silo, built from plans and specifications supplied by Mr. A. Brooks, Hawkesbury Agricultural College. This silo is now complete, but will not be filled till early summer. The erection of another silo of different design and low cost is anticipated.

Sheep.

The Romney Marsh sheep have continued to thrive well, although at one period of the year they made anything but good progress, due, no doubt, to the exceptionally heavy and continuous rain that fell in the early part of the year. It is very apparent where the sheep have been, as evidenced by the improvement in the land, both grass and fallow. They are serving their purpose in all directions. This is not what is properly looked upon as sheep country, and the introduction to this farm of the Romney Marsh was not meant as an indication of the country being thoroughly adapted to sheep raising, but merely as an adjunct to dairying for soil improvement and home consumption. For this purpose the Romney Marsh is recommended, although the Shropshire has keen admirers.

Grasses.

Great interest is shown in the grasses grown. No new trials have been made, but larger areas have been put out of those grasses giving promise in the smaller beds. Of these, Rhodes grass and *Panicum spectabile* were the best. The former still maintains its position as a most excellent grass; it grows somewhat coarse if allowed on the rich soil of this farm, and perhaps would give better results on poorer soil. It is certainly a hardy grass. With further experience of it, as with *Paspalum dilatatum*, means of treating it will be found.

Panicum spectabile is one that will not stand frost, so that it will be confined to the higher lands, and therefore does not appeal to us as an all-round grass of particular value. Referring to *Paspalum dilatatum*, I am of opinion that in the last year or so we have arrived at the proper means of keeping this grass, so that the best results are obtained, that is, by the systematic mowing of the grass during the summer, and before it

has time to grow too rank. One can see numbers of paddocks mowed side by side with those left alone, and the difference is very marked, from the point of view of the fodder available for the winter, in favour of the mown paddocks. Any farmer who wishes may obtain any variety of grass that we have under trial.

Various Fodder Crops.

Cereals.—These have been grown, as in the past, for green fodder and hay, also grazing purposes. A small trial was made with macaroni wheats, but poor results followed. Barley, oats, and rye have been grown for green feed.

Cowpeas.—Farmers are again urged to cultivate this crop, as from the results obtained here it is certain that there is no other plant of this class to equal it. As a green crop, or preserved as ensilage, it is of great value. Then its value as a green manure must not be forgotten. Experience here has shown that the Black is the best variety. The following varieties have also been tested:—White, Whip-poor-Will, Clay-coloured, New Era. The latter was a new variety tried here for the first time this year, but one season's trial has shown it to be superior to the varieties above mentioned.

Lucerne.—A new trial of this most valuable crop is now being made under directions sent through the late Mr. Farrer.

Maize.—The following varieties have been sown as a general crop, but yields cannot be given yet, owing to most of the corn being yet in the cob:—

Red Core	Iowa Silvermine
Yellow Hickory King	Horsetooth
Golden Dent	

Sugar-cane.—A fresh area was planted for the purpose of utilising it for stock, and where it can be grown it is almost an essential in dairy-feeding.

The following varieties are grown at this farm, and are available for distribution. Early application to the Manager should be made.

Black Fiji	Imperial
Louzier	Rappoo
Cheribon	Meera
Creole	Hope
Moore's Purple	Queensland
Black Java	Moris' Seedling
Caladonian Purple	Mauritius Purple
Purple St. Louis	Cudgen Purple
Black Isaaca	Striped Ribbon
Black Bamboo	Uridi
Logoa	Mau Hura Hora
White St. Louis	Tura Tura Kine
Monoa	Kou a La La

Baruma Bi Ri Ri	Topaaka
Baruma Gana Gana	Tura Rua
Didi Rufi	Nin Nin You You
Gane a Gane	Gie Gie
Katudor	Natagaia
Mahona	Gomaida
Baruma Hota	Tabu Oua
Katuri	Watu Mona
Manubadi	Keketa
Baruma	Cherom
Porai	Chemiza
Seedlings Nos. 1, 2, 3, 4, 5, 6	Geboa
Striped Isaac	China
Striped Fiji	Striped Meera
Greer Ribboa	Kokoa

Potatoes.—The season was not a good one for potatoes, and as a consequence in no case did the yield equal past records, nor was the quality even. The following varieties were tried:—

Northern Star	Freeman
Early Rose	Early Northern
Bliss's Triumph	Beauty of Hebron
Brownell's Beauty	

Of the varieties mentioned, Brownell's Beauty and Early Rose were a long way ahead of the others. Northern Star has continually proved a failure here.

Glen Innes Experimental Farm.

R. H. GENNYS, Manager.

Wheats.

The climatic conditions here this year have been most unfavourable for this crop from sowing to harvest-time, viz., from 1st May to 21st December. Only 12¼ inches of rain fell—about half of the amount that is really requisite for a first-class crop in this district. When the crops were ripe and fit to cut, heavy and continuous rain fell, making the ground boggy, and it was impossible to get on to it before many of the wheats were over-ripe, and much grain was lost by shelling-out, and in Jonathan and several other varieties it was badly bleached; in fact, the grain throughout suffered much, both in appearance and quality, through the wet weather at harvest.

From the previous year's experience, a larger area was planted with Sussex, John Brown, Power's Fife, and Jonathan. These varieties yielded well, and helped to raise the average for the whole, which was over 20 bushels to the acre.

John Brown has yielded well for two seasons, and may be considered a suitable wheat for this district.

Power's Fife, one of the strong-flour wheats, yielded over 34 bushels on the heavy black soil; but on light soil it did not do nearly so well. This wheat promises well for this cold climate, being a good flour wheat, good yielder, and good for hay; it also resists rust well.

Jonathan did not yield well the previous year; but the conditions were so adverse to a good crop that I was satisfied that, if planted earlier, good results might be expected; and as it turned out, this surmise was a correct one, for on heavy, light, and medium soils it yielded well.

The Blue Stems, of which we planted three varieties, all did well, Bolton's being the best, yielding over 30 bushels to the acre.

The new cross-bred, Rymer, bred by the late Mr. William Farrer, also gave a good yield on rather poor soil, going as high as 30 bushels to the acre. The area to be planted with this variety is to be increased, as I think this will be a good cold-climate wheat.

The wheats were bluestoned for smut or bunt with a solution of 1 lb. bluestone to 80 lb. (8 gallons) of water, and the wheat immersed between seven and eight minutes, then hung up to drain, and afterwards spread out to dry. An acre of Bobs was treated with bluestone, and an acre of the same wheat with formalin, the strength of the latter being 1 lb. formalin to 400 lb. of water, soaked for five minutes. The result of the experiment, which is by no means conclusive, was that no bunty heads were found in the Bobs that was treated with bluestone, while that treated with formalin contained a considerable number, which were carefully picked out, but few remaining, and were not sufficient in number to injure the crop. As far as my experience goes at present, it is safer to use bluestone until treatment with a solution of formalin has been further experimented with.

Time for Harvesting, and the Effect on the Milling Quality.

At the instance of the late Mr. Farrer, an experiment which may prove of vast importance to farmers generally was carried out on the farm this year. The object was to find out whether wheats harvested in the dough stage possessed a greater or less milling value than those harvested when dead ripe.

By the dough stage is meant when the grain is slightly swollen and soft, so that it can be squeezed flat between the finger and thumb, and is about the consistency of newly-made cheese. By dead ripe is meant very ripe, and at such a stage when with many wheats a considerable quantity would shell out. Should the dough stage prove the time to produce the better milling qualities, then the value of this experiment is obvious.

Many of our strongest flour wheats, such as Power's Fife, the Blue Stems, and Bobs, shell very easily, and much grain is lost in the reaping, carting, &c., if they are allowed to get ripe. The straw also will be much more valuable, being less brittle and a better colour.

Eighteen wheats, harvested both in the dough and dead-ripe stages, have been sent down to Mr. F. B. Guthrie, Chemist, Department of Agriculture, to be milled. The result will form the basis of a report to be submitted later.

This experiment is only in its preliminary stage, and its value this year was a good deal marred by the rain which fell so heavily on that which was harvested dead ripe.

This experiment, at the suggestion of Mr. G. L. Sutton, Wheat Experimentalist, is being continued and extended.

Experiments are being carried out with a large number of wheats, many new to the district. Of the wheats sold from this farm and grown in the district, the reports to hand are mostly in favour of Jonathan, Power's Fife, Bobs, and John Brown.

WHEAT CROP, 1905.

Name of Wheat.	Yield per acre.	Remarks.
	bus.	
Togo	15·01	No rust; good straw; fair grain.
Bobs (heavy ground) .. .	20·73	No rust; slight bunt.
Bobs (light ground)	12·01	No rust; no bunt; poor growth.
Blount's Lambrigg	18·58	No rust; no bunt; very uneven crop.
Sussex	21·18	No rust; slight smut; good grain.
Rymer	30·72	No rust; did well; grown in poor soil.
Minnesota Blue Stem . .	23·72	No rust; no smut; grew tall.
Bolton's Blue Stem .. .	30·4	No rust; no smut; did well; good grain.
Haynes' Blue Stem	20·2	No rust; no smut; good straw.
Scotch Fife	23·04	No rust; no smut; good straw.
Federation	18·30	Short straw; much injured by hares.
Field Marshal	15·46	No rust; no smut.
Lambrigg White Lammas .	14·66	Slight smut; uneven crop.
John Brown	22·26	No smut; no bunt; nice even crop.
Tarragon	7·01	Only odd patches with grain; appeared to be frost-bitten.
Zealand	18 36	Good straw for hay; large grain.
White Hogan	13·2	Uneven and shelled badly.
Tardent's Blue	20·93	An uneven crop; good grain; good straw.
Power's Fife (black soil) ..	34·02	A nice even crop.
Power's Fife (light soil) ...	16·01	A short, rather uneven, crop.
Jonathan	23·66	Grown in three different soils; very even quite clean.
Average	20·35	Bushels per acre.

Hudson's Purple Straw
Dart's Imperial
Farmer's Friend
} Badly rusted; unfit for this farm; in small plots only.

Macaroni Wheat (six varieties) all did well, in small plots only.

Emmer wheat did very well.

Oats.

The following varieties of oats were sown in field plots of from ½ to 15 acres, and yielded as follows:—

	Bushels per acre.		Bushels per acre.
Algerian ...	68·75	Surprise ...	23·5
Red Rust-proof ...	41·14	White Tartarian	36·
Danish Island ...	57·	Golden Giant ...	40·88
Tartar King ...	42·		

Algerian proved the best adapted, and on no less an area that 15½ acres yielded nearly 69 bushels to the acre—a most desirable variety for this district. No manure was used; but the land, which is a heavy, black soil, was well and deeply ploughed. The straw was fine and short, with remarkably fine heads. Last year a garden plot yielded at the rate of 94 bushels to the acre.

Danish Island and Red Rust-proof also did well, and appear to resist rust. Red Rust-proof comes in very early, and is very suitable for making rack hay. Golden Giant did well, and is also a good all-round variety.

Barleys.

The area devoted to barleys are only small experimental plots. The following varieties were grown:—

	Bushels per acre.
Standwell Malting	34·7
Invincible „	36·7
The Maltster „	33·7
Kinver Chevalier Malting	30·45
Brewer's Favourite	33·7
Hallet's Rejoice	33·7
Zero	6·44
Cape	3·22

Zero was a failure, and Cape barley did not stand the dry weather. The small area of Skinless barley was cut for green feed, and was much relished by stock. The grain in all cases, except Zero and Cape, was of fine size, but it was somewhat discoloured owing to wet weather at harvest time.

Ryes.

Emerald rye and White rye were sown in ¼-acre plots, and both did very well. The former is the better for green feed.

White rye being very fine in the straw, is excellent for collar-making, and the grain of both is very good.

Pumpkins and Grammas.

All varieties did well. The Ironbark, Crown, and Button are the best of the eating sorts. Of the cattle kinds, French Mammoth grew to a great size. Grammas did well.

Sugar Beets.

A few of these were sown in small experimental plots, the soil around Glen Innes being too heavy for successful cultivation of this crop; but further out towards Tenterfield the soil is more loamy and sandy, and better adapted to the cultivation of the best roots. Sutton's Sugar Beet and Vilmorin's did fairly well this year; and of the Mangolds, Golden Tankard and Sutton's Prize Winner did the best.

Potatoes.

Twenty varieties were grown in small areas, the best being—

Cambridge Kidney	Pink Eye
Irish Flounder	Early Northern
Brownell's Beauty	Aroostook County Prize
Satisfaction	Burbank's Red Russet.
Beauty of Hebron	

Northern Star and Manhattan, fair only: Red Russet, Bliss's Triumph, and Early Rose did badly.

Maize.

With the exception of a few experimental rows, in which were grown Cinquatina, Iowa Silvermine, King Phillip, Riley's Favourite, and Golden King, the first three of which did the best, Iowa Silvermine was the only one grown to any extent; estimated yield, 50 bushels. This is an early maturing sort that has done the best here so far; it is a white maize, grain of good depth and substance, and, being an early maturer, is likely to prove one of the most useful sorts for the district. Pains are being taken to prevent deterioration of the seed. Cobs are being specially selected in the field for their good qualities. Forty acres are being harvested. (14th July.) A Maelstrom corn-grinder was purchased for grinding up maize cores and immature cobs for pig-feeding and other stock. For details of experiment on pig-feeding, see *Gazette* for May, page 475.

Crossing of British Breeds of Sheep with Merinos.

The crossing of sheep for mutton purposes has been continued at this farm during the year. The sheep have been solely fed on the natural pasture, with the exception of a few weeks, when the ewes were put on a small paddock of rape. A detailed report of an experiment in crossing appeared in the *Gazette*, March, 1906, page 236.

With a view to further experiments in crossing, more pure-breds have been purchased from some of the best breeders in Tasmania and New Zealand, as follows:—

1. A two-tooth Shropshire ram, from Mr. A. E. Mansell, of Tasmania; a fine well-grown sheep.
2. A Southdown ram, two-tooth, from Mr. J. Johns, New Zealand.

3. A Border-Leicester ram lamb, and a Border-Leicester ewe, the latter the champion prize-taker at the Sheepbreeder's Show, Sydney.
4. An English Leicester ram and ewe from Mr. John Nixon, of New Zealand.
5. An improved Lincoln ram lamb, from Mr. Seth Smith, New Zealand.

These are all highly-bred sheep, and should prove very valuable for our experiments; they have been very favourably commented on by sheep men in the district.

Grasses.

Some grasses and clovers were tried in small experimental plots only.

Red Clover (*Trifolium pratense*) did very well, and promises to flourish exceedingly here. Crimson Clover also did very well. Italian Rye-grass (*Lolium Italicum*) did very well indeed, stooled well, and also grew tall.

Perennial Rye-grass (*Lolium perenne*) also did well in the district; a very useful grass.

Kentucky Blue grass (*Poa pratensis*) also did very well, and promises to be one of our best.

Texas Blue grass grew very strongly, and promises to be hard to get rid of when established; it appears to be good cattle feed.

Prairie grass grew well, but was somewhat affected with smut. Several other grasses were sown, but the seed failed to germinate. Amongst them were *Paspalum dilatatum*, Rhodes grass, Timothy, and others. Some roots of paspalum were planted, but the dry weather killed most of them before they got a start; a few roots of Rhodes grass did fairly well.

I think the grasses most likely to flourish here are Kentucky Blue grass, Perennial Rye, Italian Rye, Cocksfoot, Texas Blue, Timothy, Prairie, and also Red Clover; some acres of these are to be planted in the spring.

Pigs.

Two stud pigs of the British Large Black breed were purchased by the Director of Agriculture for this farm; both are doing well, and give promise of good size and proportions. They came from the stud of Mr. Herbert Garrett, of "Loch Maree," Thornleigh. Both pigs are from imported stock which were prize-takers in England on both sides.

The breed has the reputation of maturing very early, being very prolific breeders and growing to an immense size. Comparisons will be made later with other breeds.

Moree Experimental Farm.

W. R. FRY, Manager.

Rainfall.

From 1st July, 1905, to 30th June, 1906.

	No. of days on which rain fell.	Inches.		No. of days on which rain fell.	Inches.
July	4	·68	January ...	4	1·15
August ...	3	1·23	February ...	13	4·01
September ...	Nil.	...	March ...	6	4·31
October ...	7	·74	April ...	2	·35
November ...	6	1·30	May	4	·59
December ...	3	·41	June ...	5	1·28
Total ...				...	16·05

The past season has again been characterised by adverse weather conditions, exceptionally late frosts occurring in September and October, while the total rainfall for the year, 16·76, was nearly 7 inches below the average for twenty-three years.

Wheats.

The dry culture wheats (which were sown on 23rd May and harvested 14th November) were put to an exceptionally severe test, as between the time of sowing and harvesting only 3·57 inches of rain fell, the rainfall for September being nil, and during the month of October, the most critical time for wheat, only a few scattered showers fell. It was surprising, therefore that any grain at all was obtained. The varieties sown were the Macaroni wheats, Kubanka, Beloturka, Farrer's Durum, and Cretan; and of other wheats, Schneider, Cumberland, Federation, Bobs, Steinwedel, and John Brown. Owing to the attacks of galahs and unsuitable threshing machinery, accurate comparative results could not be obtained; but the variety John Brown was estimated to yield 5 bushels per acre, which, under the circumstances, was considered by the late Mr. Farrer as sufficiently encouraging to follow up the experiments. This variety was again sown under similar conditions.

The varieties sown this season in acre-plots are John Brown, Cretan, Federation, F (R1), Bobs, Farrer's Durum, Jade, and Steinwedel. All seed was treated with bluestone as a preventive to smut. It is proposed to continue these experiments over a number of years, for the purpose of developing a hardy type of wheat that will be profitable for grain on the black soil plains.

Experiments in fallowing and green manuring, to improve the mechanical condition of the soil, are also being conducted under the supervision of Mr. G. L. Sutton, in conjunction with the attempt to obtain a more drought-resisting wheat.

Irrigated Area.

Cereals.

In June, 1905, 3 acres of Steinwedel wheat were sown for hay, and irrigated in July and September. This grew to a height of 4 feet, and yielded 2 tons per acre of good bright hay.

Of Macaroni wheats 3 acres were sown and irrigated, but had to be cut early for hay on account of the beards, which we find objectionable in chaff.

Three varieties of oats, viz., White Tartarian, White Algerian, and Rust-proof were sown at the rate of 2½ bushels per acre. The Tartarian grew rather coarse and flaggy, and was not much relished by stock, but the Algerian and Rust-proof, both irrigated twice with bore-water, produced a splendid sample of oaten hay, which is eagerly eaten by all classes of stock.

The varieties of cereals sown this season include 3 acres Haynes' Blue Stem wheat, 2 acres Algerian oats, 2 acres Skinless barley, and 4 acres Macaroni wheat for green stuff.

Small comparative trial plots of the following cereals have also been sown :—

Wheats.—Federation, John Brown, Warner, Bobs, Rerraf, Plover, Haynes' Blue Stem, Steinwedel, Cretan, Farrer's Durum, Jade, Kubanka, Schneider, Beloturka, Marshall's No. 3.

Barley.—Eclipse, Hallett's, Kinver, Golden Grain, Skinless.

Oats.—Great Northern, Tartar King, Abundance, Colossal, Storm King, Silver Mine, Algerian, and Danish Island.

Various Crops.

Millets.

In November, 2 acres of French millet were sown and irrigated, from which a fair crop of hay was harvested in seven weeks from sowing. Pearl millet sown in March did not mature seed until June, the growth being much slower than previous years. White Italian Brown millet grew fairly well.

Teosinte.

Sown in November, germinated badly, but plants stooled well with succulent stalks, should be better than sorghum for ensilage. Seed is expensive, however; no seed matured here.

Lucerne.

The plots of lucerne which have been planted on ungraded land for five years are not doing very well, as the roots have reached the subsoil, which is a yellow clay, at a depth of 4 feet. It was cut and irrigated six times during the year, but the crops were light; it was found necessary to harrow the ground well after every watering.

Additional experiments are being instituted.

Grasses.

Small plots of the following native grasses were sown in November and irrigated three times during the summer:—*Andropogon sericeus, Eriocholoa polystachya, Chloris truncata, Chloris ventricosa, Astrebla pectinata, Astrebla triticoides, Diplachne fusca, Panicum prolatum, Pollinia fulva, Eleusine Egyptica,* and *Anthistiria membranacea* all grew well under artesian irrigation, especially the *Diplachne fusca,* or Swamp Grass, which makes very good hay.

Eleusine Egyptica.—Five Finger, or Creeping Crowfoot grass, is a quick-growing annual which somewhat resembles, but is not so good as the *Anthistiria membranacea,* or Landsborough grass. The latter, which is also known as Flinders grass, is one of the best native annual grasses under irrigation, and is much relished by stock, both in a green and dry state. The grass *Sporobolus diander* also grew vigorously with bore-water.

Salt-bushes.

Four varieties have been tried on a small scale, viz., *Atriplex nummularia, Atriplex halimoides, Atriplex semibaccata, Rhagodia hastata.*

The *Atriplex nummularia* (Old Man) made the best growth; but all grow vigorously with bore-water, and the plots will be extended as cuttings become available.

The creeping salt-bush *A. semibaccata,* which is common around this district, is the variety which has proved most successful in America for growing on alkaline soils, where it is reported to be a splendid fodder plant. In this district pastoralists do not consider it of much value, as stock will only eat it when there is little else obtainable.

Cotton.

Two plots, each ⅓ of an acre, were sown with cotton—one with Sea Island, the other with Early Carolina Prolific. The latter proved the most prolific, 220 lb. of raw cotton being obtained, while the Sea Island only yielded a little over 100 lb. The quality of the latter was superior to the Early Carolina Prolific.

A few seeds of "Caravonica Tree Cotton" were sown, and grew into strong plants 6 feet high, but no pods matured on account of frost.

Sheep-feeding Experiment.

A full account of this very interesting and instructive experiment of feeding sheep on sorghum grown by means of artesian irrigation was published in the August issue of the *Gazette,* page 780.

Ensilage.

Owing to the quantity of green feed available in February, 6 tons of sorghum were chaffed, placed in an improvised pit in the barn, and weighted with logs, &c. This has now been opened and found to be cured splendidly.

Cowra and Coolabah Experimental Farms.

G. L. SUTTON, Manager.

Cowra.

The progress made during the year has been satisfactory. The whole of the cleared area (200 acres) is now under crop. The area set aside for this year's experiments has been laid out and defined by pegs, and planted according to the schedule drawn up.

The past season was a good one, particularly good for the early crops, both of hay and grain. Up to 44 bushels of wheat per acre were obtained, and it was estimated that the hay crops (oats) averaged between 3 and 4 tons per acre.

The appointment of Mr. J. T. Pridham as assistant manager is a source of very great satisfaction.

Experiment Work.

The experiments enumerated in my last report were carried out, and are being continued again this year. The results of those carried out have been published in the *Gazette* for April, page 311.

Several experiments with wheat and with fallow crops were postponed owing to the death of the late Mr. Farrer. On my appointment as acting Wheat Experimentalist it became necessary for me to devote all my energies to prevent a break in the continuance of the valuable work of the deceased. I was in consequence unable to give that personal supervision necessary to initiate them. It is proposed to carry them out next season.

Stud Wheats.

This work is being continued. It has been increased by the transference here of the breeding work previously carried out by the late Mr. Farrer at "Lambrigg." The stud-plots contain some 1,500 varieties.

Oats.

Mr. Pridham is doing original work with this crop. His investigations have for their object the improvement of existing varieties, and the production of new varieties more suitable than the old ones for Australian conditions.

Coolabah.

Until the soil has been built and evened-up the rate of progress here will be necessarily slow, but I am pleased to report that the outlook is decidedly encouraging.

In expressing an opinion, it is necessary to point out that the last two seasons have been fairly good; but, even when this is remembered, success seems by no means impossible. The indications are decidedly favourable to the belief that, by proper rotation and management, it will at least be able to grow crops in order to make provision for shortage of feed

during droughts. I am firmly convinced that in this district success depends more upon the correct management of the soil than upon the choice of the most suitable variety or the determination of the proper fertiliser to use.

The experiments have been designed to solve this problem of soil management, and when results are available, the information will not only be valuable to this district, but to the wheat districts eastward of Coolabah.

Sheep-feeding Trial.

The first section of the trial initiated by Mr. R. W. Peacock has been completed, and the results forwarded to him. (A full report by Mr. Peacock on the above appears in the July *Gazette*, page 701.) The experiment is being continued, on the recommendation of Mr. Dickson, for a second term, or until the salt-bush is exhausted in the paddock in which the sheep are running.

Stud Wheats.

The work of selection for drought-resistance is being continued. Last season, though the rainfall during the winter and spring was very scanty, some thirty varieties matured satisfactory grain, with a rainfall during their growth of less than 3 inches. During the last three months only 9 points were recorded. The spring, however, was a cool one. Even so, such results are encouraging; it affords proof of the possibility of conserving soil-moisture with proper treatment. The patchy and uneven character of the plot on which they were grown prevented reliable comparisons being made.

Mr. Kelly, Foreman, reports that, though less than 3 inches of rain fell during their growth, grain was harvested from about thirty of the varieties sown in the stud and variety trial-plots, some producing very good samples.

In accordance with the new plans, 50 acres of rape, which had made excellent growth, were ploughed in in September, the improvement in the mechanical condition of the soil being very noticeable when working it for wheat, with which it is planted this season.

A crop of Steinwedel wheat sown for hay at the beginning of April, 28 lb. of seed per acre, was used; on 25 acres of this area the crop promises to be the heaviest and most even crop yet grown here.

Orchard.

This continues in a flourishing condition, and made splendid growth. For some reason the crop was lighter than in former years.

Useful Australian Plants.

J. H. MAIDEN,
Government Botanist and Director, Botanic Gardens, Sydney.

Leersia.

Spikelets one-flowered, flat, articulate, on short pedicels along the filiform branches of a terminal panicle.
Glumes two, complicate and keeled, the outer one the larger.
No two-nerved *Palea.*
Stamens six, or in species not Australian, three, or fewer.
Styles short, distinct.
Grain enclosed in the slightly hardened glumes,—free from them.

No. 95.—A Rice Grass (*Leersia hexandra*, Swartz).

Botanical Name.—Leersia, in honour of J. D. Leers, a German botanist; *hexandra*—Greek, *hexa*, six; *aner*, *andros*, a man (botany, stamen)—in allusion to the six stamens.

Vernacular Name.—"Rice Grass."

Botanical Description (B.Fl. vii, 549).—An erect though weak glabrous grass, attaining several feet, often rooting in the mud at the lower nodes.

Leaves rather narrow, flat when fresh, mostly erect.
Panicle oblong, 2 to 4 inches long, with erect or slightly spreading filiform flexuose branches.
Spikelets narrow-ovate, about 1½ lines long.
Glumes membranous, acute, the outer one with a prominent nerve on each side, besides the marginal one; the inner glume nearly as long, but narrow, with only one nerve on each side near the margin.
Stamens, six.

Value as a Fodder.—This grass is closely allied to that which produces rice. It is a semi-aquatic grass, which is so sparingly distributed in this State that we know but little of it from a pastoral point of view, but it is not likely ever to be important to the raiser of stock. It is, however, a tender grass, much liked by stock, and Duthie quotes Symonds as stating that cattle are fond of it in India.

A widely-distributed, perennial swamp-grass, found in warm regions of both hemispheres. In the Philippine Islands it is regularly cultivated, under the name of Zacate, for the purpose of supplying food for domestic animals. It is treated like rice, being transplanted to wet and previously ploughed meadows. Bailey found it to be one of the most relished by cattle amongst the aquatic grasses of East Australia. In Singapore it is regularly gathered in waste places as a green fodder for cattle and horses.—*Kew Bulletin*, 1894, p. 382.

Vasey speaks of *Leersia* as—

A genus of rough-leaved grasses, growing for the most part in marshy or moist ground throughout nearly all parts of the United States. There are about five species, two of which are confined to the Southern States; the others, at least two of them, are very common, though rarely occurring in great quantity. They are sometimes cut for hay. They cannot be recommended for culture, but may be utilised wherever they grow spontaneously.

A RICE GRASS, LEERSIA HEXANDRA, SWARTZ.

Fungus found on this Grass.—*Thecaphoria inquinans*, B. and Br.

Habitat and Range.—New South Wales and Queensland, from Port Jackson north. It is a semi-aquatic plant. It is especially common along the water-courses of Queensland, to a less extent on those of the northern parts of this State. It is found throughout the entire tropical zone.

EXPLANATION OF PLATE.

A. Branch of the inflorescence.
B. Branchlet of the inflorescence.
C. A single spikelet, showing the two glumes and the pistil.
D. Anthers.
E. Base of leaf and upper part of leaf-sheath, showing the ligule.

N.B.—The plan of figuring the ligule is that adopted by the Department of Agriculture of the United States. The blade and the sheath of the grass are cut at equal distances above and below the ligule, and then flattened out and figured *en face*.

In the present case the ligule is broken somewhat, but no better specimen was available.

POTATOES—BATHURST FARM, 1905–6.

R. W. PEACOCK.

A VARIETY test of potatoes was carried out at this farm upon the rich alluvial soil of the irrigation area. They were planted the second week of December, 1905, and dug May, 1906. They were irrigated four times during growth. The following are their estimated yields per acre, giving the estimated yields of marketable tubers, and small ones only suitable for pigs.

Varieties.	Total yield per acre.				Marketable potatoes per acre.				Pig potatoes per acre.			
	Tons.	cwt.	qrs.	lb.	Tons.	cwt.	qrs.	lb.	Tons.	cwt.	qrs.	lb.
Up-to-date	19	8	3	20	19	0	1	4	0	8	2	16
Southern Star	18	3	0	0	17	10	0	4	0	12	3	24
Bliss's Triumph	15	11	0	16	14	18	0	20	0	12	3	24
Sir Walter Raleigh	13	7	3	20	13	5	3	2	0	2	0	18
Anderson's No. 1	13	7	3	20	12	17	0	14	0	10	3	6
Early Manhattan	12	2	0	0	11	15	2	2	0	6	1	26
Imperator	12	6	1	8	11	17	2	20	0	8	2	16
Royalty	11	4	2	24	10	11	3	0	0	12	3	24
Freeman	10	16	0	8	10	3	0	12	0	12	3	24
Carman, No. 1	10	13	3	18	10	11	3	0	0	2	0	18
Australian Monarch	10	3	0	12	9	16	2	14	0	6	1	26
Victorian Pink Eye	10	11	3	0	10	3	0	12	0	8	2	16
Snowdrop	10	3	0	12	9	18	3	4	0	4	1	8
Aroostook County Prize	9	12	1	6	9	10	0	16	0	2	0	18
Early Puritan	9	5	3	8	9	3	2	18	0	2	0	18
Centennial	9	1	2	0	8	17	0	20	0	4	1	8
Breeze's Peerless	8	12	3	12	7	19	3	16	0	12	3	24
Northern Star	7	15	2	8	7	4	3	2	0	10	3	6
Breeze's Prolific	7	15	2	8	7	9	0	10	0	6	1	26
Early Northern	7	19	3	16	7	6	3	20	0	12	3	24
Hero	9	1	2	0	7	19	3	16	1	1	2	12
Early Ruby	7	9	0	10	7	4	3	2	0	4	1	8
Dakota Red	7	6	3	20	7	2	2	12	0	4	1	8
Peach Blow	6	13	3	24	5	8	0	4	1	5	3	20
Pride of the South	6	1	0	0	5	14	2	2	0	6	1	26
Early Vermont	5	16	2	20	5	10	0	22	0	6	1	26
Satisfaction	4	15	0	8	4	6	1	20	0	8	2	16

Stack Ensilage.

C. H. GORMAN,
Manager, Wollongbar Experimental Farm.

DURING the early part of the present year, arrangements were made to conserve as much fodder as possible for the purpose of instruction to the students, and winter feed, by means of stack ensilage. Although it is admitted that this means may not be as economical as conserving in a silo, yet it is a means that every farmer can adopt, with decided benefit to himself. Ensilage is now looked upon as a necessity in dairying districts, and where conditions are unfavourable to winter fodder, this means of providing feed for cattle is the best. Some seasons, in this district especially, it is thought that no need is felt as far as additional feed is concerned, but my advice to all dairy-farmers is, to have a supply of ensilage available, whether it is required or not; and my reason for that is, that though there may be a plentiful supply of winter feed available, feeding a fair ration of ensilage will increase the milk supply and also the quality, the aim of every dairy-farmer. On the other hand, if conditions are so favourable, and it is not thought necessary to feed it, then it will remain for as long a period as required without losing in value.

In this district one finds a large acreage of winter feed sown, mostly some of the sorghum varieties, and where frost cannot touch it a good supply is available; but towards the end of winter it is found that the crop has gone off very much, and in most instances the feeding value of the crop is very low. It would be infinitely better if, say, half the area was cut and converted into ensilage, so as to have available fodder that will closely approach the fresh green feed when first cut. Then, where frost can get at these crops, it is impossible to keep it as winter feed, and there is a greater need to adopt some means of making it available. No better plan can be adopted than to convert it into stack ensilage. Where other means are at hand, such as pits or silos, then I do not advocate the stack. But as an economical means of providing dairy cattle with winter feed, I strongly recommend to our farmers the desirability of taking up this question, not as a new-fangled idea emanating from theorists, but as something that has been proved to be of the greatest value to those engaged in the dairying industry. We know its value, but as Nature has been so good to us in this particular part of the State, sufficient thought is apparently not given to a matter that should appeal to all engaged in dairying. There are some who have followed the advice tendered by experience and illustration, and, maybe, others will follow

later on; but in the meantime, not nearly enough attention is being given to conserving fodder. Some assistance will have to be given to the conditions under which this great district works, in the direction of assisting Nature, and it will be found that conservation of fodder will play an important part.

The system of stacking followed at this farm is of the simplest form, and most of the work was performed by the students themselves, so that they would be able to follow the whole operation, from the sowing of the crop to the feeding of the ensilage. An area of 15 acres was sown specially for conserving, the crops being maize and sorghum (Planter's Friend being the variety chosen). Six acres of maize were sown, and nine of sorghum. Of this area only 11 acres were cut for stacking, as the balance was required for green feed. The cutting was done by hand, as a trial with a one-horse mowing machine proved that more time was taken picking up the cut crop falling in all directions, than by use of a reaping hook directing the fall at each stroke. The height of the crop also had a lot to do with the machine not working satisfactorily. As soon as cut, the crop was carted at once to the stack and put down in layers about 18 inches to 2 feet thick, each layer crossing the other. This course was pursued in order to permit of proper regulating and building of the stack, and continued until the stack was the desired height. It might be well to mention that the formation of the base of the stack was made by placing discarded fencing timber on the ground, packed up to about 15 inches from the ground. On top of this bed was placed a few loads of grass hay. Straw would do just as well. When the stacks are built high enough, pressure is applied. This was done by means of two heavy logs, strapped over the stack with galvanized fencing-wire, and held up about 6 or 8 feet from the ground until the wire was made secure to the logs; they were then let go, and the weight of the logs was found quite sufficient for the pressure required. Before preparing to apply pressure, the stacks were trimmed off, the trimmings being thrown into the centre of the stack, and the stack itself finished off in a similar manner to haystacks, with the addition of a little covering of grass hay or straw. The stacks were started in February of this year, completed in March for the first stack, April for the second, and May for the third. The first stack was opened in June and used till finished; the second was opened a few days ago; and the third is available when required. It may be that the third stack will not be required just yet, as spring feed will be available soon; but it can be made use of at any time. Stack No. 1 was made up of maize, and the sample was an excellent one in every particular. Stack No. 2 was made up of sorghum, also of high quality. Stack No. 3 is made up of sorghum and Mauritius beans. The sorghum in this stack was rather dry, and might be looked upon as half cured before cutting. So far as I can judge, there was more waste about stack No. 1 than No. 2, due, I think, to the fact that the maize was the more difficult to stack; but I am quite safe in saying that there was not more than a foot all round in No. 2 and about 15 inches in No. 1. Both

stacks measured 15 ft. x 15 ft. x 7 ft., and, allowing 50 cubic feet to the ton, this would give a content of 31½ tons each. Stack No. 3 measured 18 ft. x 16 ft. x 8 ft. high, and would contain about 46 tons. I am of opinion that it is desirable to make stacks no smaller than No. 3, and in future, stacks will be built so that the average size will contain about 50 tons. This is a convenient size to build, and is more economical in the matter of waste. As far as the question of cost is concerned, it is hard to arrive at the value of student labour per day, but I am within the limit when I estimate that the cost of cutting, carting, stacking, and completing the quantity made, viz., about 110 tons, at 3s. 6d. to 3s. 9d. per ton.

Several farmers have mentioned that there appears a difficulty about getting cattle to take to ensilage. That may be so; at first it is no easy matter to get any live stock to take to new fodder, but I am perfectly satisfied that no insurmountable difficulty exists at all in this respect, after the first few days that the cattle are fed on the ensilage. Once they have acquired the taste, they will leave nothing in the shape of waste. Some cows may take a little longer than others, but none will reject it. As far as its effect on the milking qualities of the cattle are concerned, it is hardly necessary for me to remark, our milk yields will speak for themselves, when all conditions are taken into consideration. Our young stock have also been fed with ensilage this season, and they have taken to it readily and show the effect.

I have omitted to refer to one point in connection with the waste arising from stack ensilage, and that is this. If care is used in cutting the stack in the first instance, much of the waste may be utilised by mixing it with the good portion—that is to say, if the fodder is to be chaffed, the apparently useless portion may be consumed with the good. This is a matter, however, in which discretion must be used.

Almost any green crop can be converted into ensilage, and it is not at all necessary to confine oneself to the crops mentioned. I have been shown some splendid ensilage made from *Paspalum dilatatum* by a member of the Alstonville Agricultural Society, and where we have so much of that wonderful grass going to waste, it is a wonder that more of it is not converted into ensilage.

Maize for ensilage was cut when the cob was in the dough stage—that is, when the grain is firming. It has been found that at that period of growth the greatest yield of green fodder can be had, in addition to the feeding value then being superior.

Sorghum for ensilage was cut when the seed had hardened and just before it was fit to harvest for seed purposes. I find that this is the best time to cut for ensilage. In stack No. 3 this is clearly shown. The fodder in that stack was allowed to remain over until half dry, and the result shows that the ensilage is dryer and not so well liked by stock. (This note is added after preparation of first portion of article, in which

it was thought that stack No. 3 would not be used for some time. It has since been opened and found to be good fodder, but not so succulent or good in colour as No. 2.)

My conclusions, therefore, are that for stack ensilage, maize should be cut when the grain is firming, and sorghum when the seed has hardened and before the stalks show any signs of wilting. In stack No. 2, the sorghum came out almost the same colour as it was put in, but in No. 3 the ensilage was very dark, almost black, crumbly, and not so well-liked as that from No. 2. At the same time, if circumstances prevent stacking at the proper time, I do not advise abandoning the crop for ensilage purposes because it has gone too far, but if the best results are desired, it is necessary to stack at the time mentioned.

With *Paspalum dilatatum*, the best results can be obtained by cutting when the seed heads have properly formed, or before the grain has set.

A 100-ton tub silo has recently been erected at this farm, from plans and specifications prepared by Mr. A. Brooks, foreman carpenter at the Hawkesbury Agricultural College. Later on the cost and all particulars will be published for general information.

District farmers will be made welcome at this farm, and be given all the information available on the subject of ensilage at any time.

Conference of Agricultural Chemists.

The desirability has long been felt of holding a meeting of the agricultural chemists of the different States for the purpose of discussing and rendering uniform the work done by the official chemists, and adopting uniform methods of analysis.

In February, 1904, the Council of Agriculture, Tasmania, despatched an official invitation to the Agricultural Departments of the other States for their chemists to attend such a Conference to be held in Hobart in April, 1904. This date was subsequently altered to June, 1904, and was finally abandoned as the representatives of Queensland, Victoria, South Australia, and Western Australia were unable to attend. In November, 1904, a similar invitation was issued by the Victorian Department of Agriculture to a conference to be held in February, 1905, in Melbourne.

In January, 1905, the Victorian Department wrote stating that as the replies received did not indicate that the meeting would be sufficiently representative, it had been decided to postpone the Conference.

In July of the present year an invitation was issued to the Agricultural Departments of the different States and New Zealand, asking them to allow their chemists to attend a Conference to be held in Sydney on August 20th, 1906.

Favourable replies having been received from all the States, except South Australia and Tasmania, the Conference was opened on the date mentioned, and was attended by the agricultural chemists of Queensland, Victoria, New Zealand, and New South Wales (the Western Australian representative being unable at the last minute to attend).

The meeting asked Mr. J. M. Hattrick to act as honorary secretary; and held twelve meetings at the rooms of the Royal Society of New South Wales, which were kindly lent by the society for the purpose.

The following is a short *résumé* of the work done by the conference:—

Reports on Soils for Farmers.

(*a*) Details of form to be filled in by applicants for advice as to treatment of soil.

(*b*) General directions for obtaining and forwarding samples of soil if an analysis is required.

(*c*) Form of report on the analysis of the soil.

Methods of Analysis.

1. For soils.
    - Mechanical analysis.
        - Meshes of sieves; apparatus for elutriation; preparation of air-dried fine soil.
    - Chemical analysis.
        - Details of methods to be adopted for—
            - (*a*) Hydrochloric acid method.
            - (*b*) Citric acid method.
2. Manures.
    - Bone-dust.
    - Superphosphate.
    - Basic slag.
    - Nitrogen in different forms
    - Potash in fertilisers.
    - Mixed manures.
3. Feeding stuffs.
4. Wheat and flour.
5. Dairy produce (including boric acid and formaldehyde)—
    - (*a*) Milk and cream.
    - (*b*) Butter.
    - (*c*) Cheese.
6. Waters—for irrigation, watering stock, and use in butter and cheese factories.
7. Other substances.
    - Lime.
    - Insecticides.
    - Cattle dips.

Legislation regarding adulteration of Fertilisers and other Agricultural Products.

In view of the importance of the subject, and the fact that all the States were not represented, the question of legislation and of fixing standards of purity was postponed until the next meeting.

Soil Surveys.

The great value of properly-organised soil surveys of the different States was affirmed, but it was recognised that it was not feasible to carry out such a survey on the lines adopted by the United States Department, and a referee was appointed to investigate means for making short flying surveys, and to test the rapid methods of analysis adopted by the American Bureau of Soils.

Field Experiments.

The Conference was unanimously of the opinion that all field-experimental work should be carried out in conjunction with and under the supervision of the agricultural chemists, in so far as relates to design and conduct of the experiments themselves, and the interpretation and publication of the results. Further, that manure experiments in the States have in the past been carried out on a limited number of crops, and that it is desirable to conduct exact scientific experiments with a greater variety; special mention being made of fruit-trees, vines, and potatoes.

The following was laid down as the objectives of field-experimental work:—

1. To determine the effects of fertilising substances, separately and in combination.
2. The best and cheapest forms and quantities in which these ingredients should be applied, and the most effective means of applying the manures containing them.
3. Nitrification and the bacterial methods of soil-treatment.
4. Action of amendments, such as stable and organic manures, lime (as carbonate, ground quicklime, and as slaked lime), ferrous sulphate, and magnesium salts.
5. Different methods of soil-treatment, such as draining, subsoiling, ploughing to different depths, and green-manuring.
6. Variety tests for the crops, and varieties best adapted for given conditions of soil and climate.
7. Methods of treating special soils, such as salty and alkaline soils.
8. Eradication of noxious weeds by chemical or other means.

The above problems may be investigated in three ways—

(*a*) by means of experiments conducted at State farms and agricultural colleges;
(*b*) by experiments on the farms of private individuals;
(*c*) by means of plots in school gardens.

Pot Experiments.

Field experiments are to be supplemented by pot experiments, by means of which certain problems can be best investigated.

Reciprocity.

The Conference affirmed the desirability of reciprocity between agricultural chemists, and passed the following resolution:—

"That reciprocity between the chemists of the various States and New Zealand is highly desirable, and that this can best be brought about by the interchange of publications, and of such other matters as may be deemed of mutual interest; and, secondly, by periodical meetings, which may be best secured by the formation of an association."

Association of Official Agricultural Chemists.

The following constitution for the above association was adopted:—

1. This association shall be known as "The Association of Official Agricultural Chemists of Australasia." The objects of the association shall be—
   (1) To secure uniformity in the methods, results, and modes of statement of analyses of fertilisers, soils, feeding stuffs, agricultural products, and other materials connected with this industry.
   (2) To afford opportunity for the discussion of matters of interest to agricultural chemists.
2. The chief chemists for the Departments of Agriculture in the States and Colonies of Australasia shall be members, *ex officio*. In the event of the unavoidable absence of one of the members from a meeting of the association, he may nominate an official of his staff to act as his representative, and such representative shall have, for the time being, all the privileges of membership.
3. The officers of the association shall consist of a President, Vice-President, and a Secretary, and these three officers, with one other member to be elected by the association, shall constitute the executive committee.
4. The executive committee may appoint from time to time a recorder.
5. There may be appointed by the president at the regular meetings a referee for each of the subjects to be considered by the association.
6. The special duties of the officers of the association may be further defined when necessary by the executive committee.
7. The meetings of this association shall be held at such places and at such times as shall be decided by the executive committee.
8. Any alterations or additions to this constitution shall only be made with the consent of a majority of the members of the association.

The Association of Official Agricultural Chemists, as above constituted, was then formed, and the following office-bearers were elected:—

President	F. B. GUTHRIE.
Vice-President	C. J. BRÜNNICH.
Secretary	W. PERCY WILKINSON.
Member of Executive Committee	B. C. ASTON.

The proceedings of the present Conference were then formally adopted as the proceedings of the first meeting of the association.

It was resolved that the second meeting should be held, if possible, in Sydney in March or April, 1907, as much important matter had been reserved for discussion with representatives of all the States.

It was resolved that the Governments of the various States and Colonies be advised of the formation of the association, informed of its aims and objects, and asked to give it official recognition.

Other resolutions were passed as follows:—

1. Copies of analyses made by the official chemists should not be used for advertising purposes, and some steps should be taken to prevent such abuse.

2. Samples of soil for analysis should, where possible, be taken by an officer of the Department of Agriculture, under the direction of the chemist.
3. The glass-ware used in dairies and butter factories ought to be of approved form and make, and all calibrated glass-ware should be submitted to the agricultural chemist for testing and verification, and if found correct should receive an official stamp. The limits of error tolerated to be decided at the next Conference.
4 Further investigation on Kjeldahl's method for the determination of nitrogen with and without the use of mercury is necessary.

   [Mr. Brünnich was appointed referee.]
5. It is desirable that in all cases of alleged poisoning of any animal in which a chemical analysis is required, a *post-mortem* examination by a veterinary surgeon should be made, and the chemist advised of the result before he undertakes the analysis.
6. Mr. Aston was appointed referee in the matter of the determination of iron and alumina occurring in phosphate rock, to report to next Conference.

Phylloxera Resistant Stocks—Explanation of Reputed Failure.

A sample of a resistant stock that had been grafted, and after apparently doing well, showed too much colour in the foliage, and in some cases the season before vines showing a similar colour, died right out, was forwarded to the Viticultural Expert, Mr. Blunno, for report.

Mr. Blunno says:—" I examined very carefully the specimens of grafted resistant stock submitted. The stock (*Gloire de Montpellier*) was sawn off below the zone of graft, therefore the section was through the stem of the phylloxera resistant stock, which was normal. However, I cut through the zone of graft and found that the scion had not united with the stock—that is to say, the prosenchymas or fibre-tissues never joined to form a whole, as they should in successful grafts. Failing to entirely join, the contact surface of stock and scion was separated by a layer of dead tissues extending all over the surfaces laid bare when making the graft. The scurfy and spongy tissues called broussins, in which part of the bark is transformed into spongy tubercular tissues gradually in working, are but the outcome of the weakening of the plant, caused by the failure of a regular circulation of the sap, whereby the tissues around the zone of graft grew very little, and hardly renewed themselves. Broussins quite identical are to be found on old and weak vines, or on vines that have suffered from neglected large cuts or bruises, even when such vines have not been grafted. I am firmly convinced that the stock has nothing to do with the lamented failure, and anyone having vines showing similar symptoms may rest assured that this is not a case of any particular disease."

Stock Conference.

A Conference of State Stock Inspectors was opened at the Public Offices, Melbourne, on 28th August by the Minister of Agriculture (Mr. Swinburne).

The delegates were:—Messrs. T. A. Tabart (Chief Inspector of Stock, Tasmania), who was appointed Chairman; J. P. Orr (Deputy Chief Inspector of Stock, Queensland); A. H. Cory (Government Veterinary Surgeon, Queensland); J. D. Stewart (Government Veterinary Surgeon, New South Wales); R. J. Needham (Chief Inspector of Stock, South Australia); J. R. Weir (Chief Inspector of Stock, Victoria); and S. S. Cameron (Government Veterinary Surgeon, Victoria).

Dr. Cherry, Director of Agriculture, was also present.

Mr. Swinburne said he had great pleasure in welcoming the delegates to Victoria. The Conference might have far-reaching effects on some of the important subjects it would discuss. The chief question to be considered was uniform methods of stock inspection. At the Premiers' Conference, it was agreed that it would be of advantage to establish a true federal spirit in this work. New South Wales had taken the initiative in calling this Conference, in the hope that some uniform system of inspection would be inaugurated. As it is now, the States do not trust each other, and border inspection has to be maintained. It would be better to trust each other, and accept certificates as to freedom from diseases issued by neighbouring States. As far as Victoria was concerned, it was willing to accept the certificates of the other States, as long as it was assured that inspection was thorough, and the certificates could be accepted with confidence. It would be a great advantage, also, if the Stock Departments of the respective States would promptly notify each other of fresh outbreaks of stock diseases, as, for instance, anthrax, in order to protect neighbouring States as well as their own.

The subject of interstate restrictions and the inspection of stock passing from one State to another, with the view to prevent the spread of stock diseases, first occupied the attention of the Stock Conference. The meeting was held in committee, and the various methods of stock inspection and the suppression of stock diseases in each of the States was exhaustively reviewed.

It was found impossible to recommend uniformity for all the States in respect to internal methods of stock inspection, but a system of exchanging reports on fresh outbreaks of stock diseases was approved of, on the lines suggested by the Minister of Agriculture (Mr Swinburne) when he opened the Conference.

The following resolution, proposed by Mr. Cameron (Victoria), and seconded by Mr. Stewart (New South Wales), was agreed to unanimously:—

This Conference is of opinion that it is eminently desirable, as it appears also to be feasible and practicable, that a system of interstate exchange of reports of outbreaks of anthrax, cattle-tick infestation, pleuro-pneumonia contagion, swine fever, and any exotic communicable animal disease be inaugurated, whereby all the other States may be at once notified of the occurrence of such outbreak in any State. This for the reason that while it appears to be impracticable to bring about uniformity in the system of internal stock inspection under existing legislation of the States; and because of the various local, geographical, and other conditions prevailing in the different States, such a system of interstate exchange of reports would tend to facilitate modification of the existing system of interstate restrictions and border inspection of stock.

The following resolutions were also carried :—

In view of the fact that anthrax is now a notifiable disease in New South Wales, and that provision is made for compulsory vaccination when deemed necessary, the passage of stock from one State to another should be governed by the same restrictions, namely, the certifying by an officer of the Stock Department of the respective States as to the freedom of stock from anthrax, and, if unvaccinated, also as to the freedom from infection of the holding from which they came, and the route by which they travelled.

That this Conference is of opinion that the measures adopted by New South Wales in regard to the introduction of working horses across the Queensland border are efficient, and are an adequate protection for the other States, without the imposition of further restrictions by such States.

That this Conference is satisfied with the methods adopted by New South Wales in preventing the spread of tick from Queensland, and agrees that, contingent on increased precautions in certain directions being agreed on between two States, a reasonable decrease of the period of detention in buffer areas may be safely allowed.

That in the opinion of this Conference it is desirable, in the interests of interstate stock traffic, that Victoria should have legislative power, as now exists in New South Wales, Queensland, and South Australia, to enforce protective inoculation for pleuro-pneumonia and vaccination for anthrax of stock recently exposed to risk of infection with this disease.

That the introduction of an efficient Brands Bill by Victoria, providing for a system dissimilar to those adopted by other States, is strongly recommended.

That in the opinion of this Conference, foreign vessels should be continuously in Australian waters for three months before being deemed clean.

That in the event of rabies not appearing in the United Kingdom during the ensuing twelve months, the advisability of reducing the period of quarantine imposed on dogs imported from Great Britain should be considered.

That it is advisable to hold ships' dogs in a properly quarantined establishment whilst vessels are in port.

That the system of quarantining horses and dogs on private premises, as practised in Victoria, is regarded as a distinct menace to the animal health of the Commonwealth, and should be immediately abolished, and that provision be made for properly quarantining these animals.

That in view of the magnitude of live-stock interests in Australia, which interests are threatened by the existence in India, Africa, the Philippines, Malay States, and the East Indian I lands (including New Guinea) of the following diseases, namely:—Dourine, surra, rinderpest, South African horse sickness, and nagana, and while recognising the value of the precautions taken, this Conference recommends that the importation of stock from these countries should be absolutely prohibited.

That the admission of cattle into the Commonwealth from countries in the Northern Hemisphere during the months of September, October, November, and December is not desirable owing to risk of introducing the warble fly.

The subject of pleuro-pneumonia was also discussed, chiefly with reference to the Tasmanian quarantine regulations against stock from the mainland, which, members generally held, were unnecessarily harsh. Breeders on the mainland are at considerable disadvantage, it was stated, owing to the long period of 130 days' detention which is insisted upon. In deference to the wish of the Tasmanian delegate, Mr. Tabart, a resolution on the subject submitted by Mr. S. S. Cameron (Victoria) was withdrawn, it being understood that Mr. Tabart would direct the attention of the Tasmanian Government to the views of the Conference on the subject for serious consideration.

—*Australasian.*

A few Notes on some Cowpeas.

A. A. DUNNICLIFF,
Inspector of Agriculture.

It was rather late last season when I obtained a few seeds of some new varieties of Cowpeas, *i.e.*, new to most of us here. I thought it well to endeavour to plant them for observation, and for comparison with older and well known sorts, also to increase the stock of seed. My friend, Mr. H. Davey, of Wyong, kindly offered his assistance both in the matter of ground and attention, but the only land then available was a piece of an old road—the former approach to the homestead; and owing to the way in which it was impacted, after carrying thirty years' traffic, we were unable to then break it up more than four (4) inches deep.

On 27th December last drills were drawn out 2 inches deep, 3 feet apart, and 66 feet (1 chain) long; and the seeds sown about 8 inches apart in the rows. This was necessitated by the very small quantity of seed of the most important kinds—the new ones—namely, Chinese Mottled, Chinese Red, Iron, Brown Eye, New Era, Early Black Eye, and Stranger. The old varieties, which were put in competition with these were Black, White, Clay-coloured, Warner's Hybrid, Warner's Early, Whip-poor-Will, and Upright.

All showed well above ground by 2nd January, and grew well, notwithstanding a long spell of dry weather.

After making two months' growth I commenced a series of fortnightly judgings by points to show their relative values in earliness, production of fodder, formation of pulse, healthiness, &c., &c.; and it was very interesting to note how the different kinds changed their positions, losing or gaining points after every variation in the weather. This information would have been valuable for those farmers whose climatic conditions are sometimes difficult, but unfortunately other duties demanded my attention elsewhere for parts of May and June, when the growing season was closing, and therefore this matter was not satisfactorily completed.

I give some account of the growth of each variety, and those farmers who are acquainted with those I call the *old sorts* will be enabled thereby to better estimate the value of the said *new ones*.

Black.—Flowered 1st March. Pods formed mostly within four days; height of herbage, 18 inches; length of runners, 4 feet; a medium late variety; pods slow in ripening, but giving a good return of pulse.

White.—Flowered 10th February. Height of foliage, 21 inches; length of runners average 8 feet; bulk of herbage, about medium; yield of pulse, very good. The earliest variety of all, in every respect. If it had been cut when in flower, no doubt a second crop would have been obtained.

Clay.—Flowered 5th March. Height of foliage, 12 inches; runners about 18 inches; fodder, poor and scanty; small returns of pulse. A late variety, and the least valuable in this series.

Warner's Early.—Flowered 16th February. A good early variety, but little later than White or Early Black Eye. Height of herbage, 24 inches; average length of runners, 7 feet; bulk of herbage between "medium" and "good"; a good quantity of pulse. One of the best early varieties.

Warner's Hybrid.—Flowered 23rd February. Practically the same in all respects as the preceding, except colour of seed.

Whip-poor-Will.—Flowered 1st March. Average height, 4 feet; runners going quite 10 feet; bulk of fodder very good; return of pulse very good. One of the largest yielders, both of fodder and pulse, but late—the latest kind of all to mature. A splendid variety where late feed is required, as it will continue to grow until cut off by hard frosts.

Upright.—Flowered 23rd February. Height of herbage, 21 inches; no runners; bulk of herbage poor; yield in pulse light in weight; grain very small. This result was not borne out in a large field experiment (at same time), when the height of herbage was 27 to 30 inches; runners, 3 to 4 feet long. One of the earliest varieties, and a large yielder of green fodder; in comparison with other sorts was a very easy crop to handle in every way. Another test from same seed on virgin land gave a great wealth of herbage, reaching a standard height of 4 feet 6 inches.

Chinese Mottled.—Flowered 10th March. A slow-growing and late variety; height of herbage, 4 feet; the runners went to 15 feet, averaging 10 feet. A great bulk of herbage, giving a large amount of fodder, and good return of pulse. One of the best, when earliness is not a consideration.

Chinese Red.—Flowered 4th March. Also a slow-growing, late variety; giving rather more herbage than Chinese Mottled; average length of runners, 11 feet. Matures about same time, and returns of pulse also similar.

Iron.—Flowered 7th March. Height of herbage, 4 feet; length of runners, 10 feet; heavy producer of fodder, having abundance of foliage, with stems up to 1 inch in diameter. A good return of pulse. Medium early, and believed to be one of the most valuable varieties in existence at present. This test was on a bit of very inferior land.

Brown Eye.—Flowered 15th March. A late variety; herbage only fair—height, 15 inches; runners, 4 feet; pulse fair. A new variety, but unequal to many sorts hitherto cultivated.

New Era.—Flowered 18th February. A rapid grower; height of herbage, 2 feet 6 inches; runners average 8 feet; bulk large, and pulse return large. Almost as early as the White, and one of the largest bearers of fodder and pulse. Continues forming pod during the whole period of growth. Could easily have been cut at two months, and then would have given a second crop. One of the best varieties.

Early Black Eye.—Flowered 12th February. Earliest of all in pod, and earliest in maturing, except *White*. General height, 21 inches; runners average 5 feet; bulk of herbage medium, and ready a month earlier than *Black*; pulse medium in quantity. Worthy of further trials.

Stranger.—The land on which this promising new variety was grown was much inferior to any of the others, and, therefore, until further trials are made, comparisons would be unfair and unserviceable.

Order of Maturing Fodder.	Order of Maturing Pulse.	Order of bulk of Fodder.
{ White	White	Iron
{ Early Black Eye	Early Black Eye	{ Chinese Mottled
New Era	New Era	{ Chinese Red
{ Warner's Early	Upright	{ Whip-poor-Will
{ Warner's Hybrid	Warner's Early	New Era
Upright	Warner's Hybrid	{ Warner's Early
Iron	Iron	{ Warner's Hybrid
Brown Eye	Black	{ Early Black Eye
Clay	Brown Eye	{ White
Black	Clay	Black
{ Chinese Mottled	Chinese Mottled	Brown Eye
{ Chinese Red	Chinese Red	Upright
{ Whip-poor-Will.	Whip-poor-Will.	Clay.

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The following is the order in which I would place them for general purposes *i.e.*, fodder and green manure, when *time* is the chief consideration:—White or Early Black Eye (which appear to be practically the same variety), and New Era. When time is not a matter of importance, I would place them in this order:—Iron, Chinese Mottled, and Chinese Red, Whip-poor-Will, and New Era.

Soil Inoculation in Cowpea Series.

None of the seeds of this series were inoculated, but soil was treated with the culture, and applied broadcast to a part of the land, covering one-half the length of all the rows. No difference could be noted at any time in the growth of herbage and pulse; but towards the maturing of the plants the roots were examined, and it was found that the nodules were more numerous and of larger size on the treated land than on the other portion, many of them being ovally shaped, five-eighths of an inch long by one-quarter of an inch in diameter, and running up to fifty in number; whereas on the untreated land the largest number found was thirty, and the greatest size three-eighths of an inch by one-eighth. Probably if a longer period of growth had been possible the number of nodules would have been largely increased in both sections. It seems to us that this trial points to the fact that no great benefit is obtained from the bacteria by the growing crop in this method of inoculation; but, judging by the numbers and sizes of the nodules, a considerably greater quantity of nitrogen must be stored for use of future crops in the land so treated. In lifting the plants for inspection of the roots, we found it very difficult to arrive at a correct estimate of the quantities of nodules produced, on account of the ease with which they detached from the roots on any movement of the soil, and the large number which had evidently matured and dispersed.

Trial packets of seeds of any of the above-mentioned Cowpeas may be obtained by application to the Director of Agriculture, Sydney.

Orchard Notes

W. J. ALLEN.

OCTOBER.

IN the last number of the *Agricultural Gazette* I gave directions for spraying apple, pear, and quince trees with arsenate of lead, for the destruction of codling moth, and from time to time I have published in these notes directions for mixing the arsenite of soda solution. It may not, however, be out of place to repeat the latter. As soon as the petals have fallen the trees should be sprayed with the arsenite of soda, mixed as follows:—

Stock Solution.—1 lb. of best arsenic and 2 lb. of washing soda boiled in 1 gallon of water for about three-quarters of an hour, or until the mixture is quite clear. Then add 1 pint of this stock solution to 40 gallons of water, to which has already been added from 6 to 8 lb. of best freshly-slaked lime. If this latter precaution is neglected, the result will be serious damage to the foliage. Some varieties of apples are much more tender than others; for these use the larger quantity of lime. The arsenic is much cheaper than Paris green, and when bought in quantities should not cost more than about one-third as much per pound. For this State, I am of opinion that at least four sprayings will be necessary to keep the moth in check.

If it is desired to add bluestone to the arsenite of soda solution, 3 lb. of bluestone may be dissolved in 1 gallon of hot water, by suspending the crystals at the surface of the water in a bag of open material, and when thoroughly dissolved can be made up to 20 gallons by the addition of more water. Now take 1 pint of the stock solution of arsenite of soda and dilute in 20 gallons of water, in which from 6 to 8 lb. of freshly-slaked lime has been added, and pour this into the bluestone mixture, thus making the whole up to 40 gallons. Strain before using.

In spraying, use as fine a nozzle as possible, the object being to cover the tree with as fine a mist as possible without any of the solution running off.

It will be well to get the bandages on the trees towards the latter part of the month, and these should be removed and examined every ten days after the grubs have made their appearance, and all grubs and chrysalids destroyed by cutting them in halves with a sharp knife carried for the purpose.

Keep a strict watch on all refills, and if these show any signs of wilting give them one or two buckets of water from time to time until they get a good start.

Disbud all newly-planted trees, leaving good shoots at least 4 inches apart along the trunk of the tree, and do not allow two or three shoots to start from the same place, as so many have done, but give each branch a separate hold of the main stem.

If the sap is well up, citrus trees may be successfully budded this month. Keep all dormant buds and grafts well disbudded, so that the bud may get away good and strong. No suckers or shoots should be allowed to grow below the buds. It is also very essential that stocks should be cut back properly. The cut should be slanting, being slightly lower on the side opposite to the bud, and it is advisable to stake them, not only to prevent their being blown out, but to encourage a straight trunk.

Where grafts have been put in old trees, they are even more liable to be blown off than small ones, and must be tied to prevent it. To do this, a good stake should be tied to the branch grafted, and allowed to project a foot or more over the end; then as the graft grows it can be tied to it.

While working around trees, watch for borers on the trunks and branches, as it is very easy, when they are just starting their work, to cut away the bark and find them, in this way keeping the orchard free of this pest.

As soon as the vines begin to grow, sulphur them at least once before blooming, for mildew, and twice if the weather is very damp. In coastal districts it is well to spray them, immediately after the fruit is set, with Bordeaux mixture, and, should caterpillars of any kind be eating the leaves, add to the solution Paris green, in the proportion of 1 oz. to 20 gallons. Repeat the sulphuring from time to time, giving as many as eight applications if the season is at all damp. This will pretty well keep the oïdium in check.

Keep all vines well disbudded. I have noticed in many small vineyards that this important work is neglected. Never allow any branch to grow below the crown of the vine. To do the work properly, it will be necessary to disbud all vines from two to three times.

Growers should see that the orchards are cleaned up as early as possible, and the soil worked up to a good depth and cleaned of all weeds, so that any moisture in the soil may be conserved for the sole use of the trees and fruit.

Two-horse Cultivator.

This is an implement which we use in our orchards during the spring and summer to keep the land well stirred up, and also to keep down all weeds. With this cultivator and two horses, from 6 to 8 acres per day can be thoroughly stirred up. If the driver is careful he can go within

a few inches of the trees or vines without injuring them. We usually zig-zag among the trees with this implement, so as to cover as much of the land as possible, and it is found that with care very little work is left to be done by hand.

Two-horse Orchard Cultivator.

MONTHLY WEATHER REPORT.

HAWKESBURY AGRICULTURAL COLLEGE.

SUMMARY for August, 1906.

Air Pressure (Barometer). Lowest.	Highest.	Mean.	Shade Temperature. Lowest.	Highest.	Mean.	Mean for 14 years.	Air Moisture Saturation=100. Lowest.	Highest.	Mean.	Evaporation (from Water Surface). Most in a Day.	Total for Month.	Monthly Mean for 8 years.	% of year's Evaporation.
29·74 31st.	30·52 8th.	30·23	25·1 14th.	74 2 17th & 23rd.	51·29	51·517	49 23rd.	100 9th, 18th, & 30th	71·35	·132 1st.	2·264	2·096	4·9

Rainfall...	Dates	6	9	11	18	19	20	27	30	31	Total,	Mean Rainfall for 14 years.
	Points..	1	6	2	17	37	5	1	68	153	290.	206 points.

	N	NE	SE	S	SW	W	NW
Wind ...	7	2	2	11	2	1	1

Greatest daily range of temperature, 40·8, on 3rd.

Thunderstorm on 17th.

Frosts—2nd, 3rd, 4th, 12th, 13th, 14th, 22nd, 27th, 28th, 29th.

W. MERVYN CARNE,
Observer.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

Directions for the Month of October.

Vegetables.

No one in the country should be in want of vegetables during the month, for the season has been so good that vegetables of numerous kinds are growing most luxuriantly wherever they have been planted. The prospects of the continuation of a favourable season seem to be satisfactory, and warrant the planting extensively of all seasonable vegetables. The chief labour in connection with gardening will be the getting rid of the weeds which are sure to grow, especially in the warm, humid districts about the sea coast, where sometimes their growth is wonderfully rapid unless they be kept under almost as soon as the seeds germinate, and it is difficult to destroy them, should rainy weather occur and continue for a few days, where the land is good and rich. In such places tomatoes are likely to be fruiting and ripening their fruits in abundance; but, on the other hand, about the high parts of the tableland the plants may be just starting to grow, and, even during October, they may need protection from frosty nights. Whenever the weather is fine, as much digging, weeding, planting, and sowing should be done as possible, and when any land is vacant, dig it up, manure if necessary, and plant or sow some other kind of vegetable, working on a well-considered system, and by that means a much smaller area will suffice than if the gardening is carried out in a muddle.

Beans, French or Kidney.—The numerous varieties embraced under this group are of much value for summer, and should succeed almost everywhere if the seed be sown during the month. Should the soil be of poor quality, the use of superphosphate of lime, gypsum, lime, lime-rubbish, or bone-meal may be used in conjunction with farmyard manure, but if lime or ashes be used they should be applied after the farmyard manure has been dug into the ground.

Sow the beans in rows, and if the dwarf kinds are to be sown make the rows 2 ft. 6 in. or 3 feet apart. The runner beans should be sown much wider apart than this, but if these be stopped they can be kept comparatively low—say, 3 or 4 feet—but they will need sticks, or wide-mesh wire-netting will answer very well. Mark out drills 3 to 4 inches deep and drop the seeds from 4 to 8 inches apart, according to variety. Have all vegetables in rows running in the same direction, and then it will be found that the work of cultivating, weeding, &c., will be much easier than if some of the rows of vegetables run at right angles to others.

Beans, Lima.—This is a useful kind, and is very much liked by some persons. The seeds and not the pods are used. There are dwarf varieties and runner varieties, but the latter will probably be found the best to grow. Each plant of them when full grown will occupy a large space, therefore provision should be made when planting seeds.

Beet, Red.—This is a salad vegetable which is generally much appreciated during the hot days of summer, therefore a supply should be kept up, and by sowing a little seed every now and then a succession can be managed without any difficulty. It can follow cabbage, cauliflower, broccoli, or any of the Brassica family for which a good deal of manure has been used, so that there will be no need to manure afresh for red beet. As soon as a few cabbages are removed, the space occupied by them can be dug up and beet seed sown. The seed can be sprouted before sowing if kept in a warm place between damp bagging, but if this method be adopted take the precaution of watering the soil along the drill well before the seed be dropped along it. If sown in dry soil and dry weather prevails, the young sprouts will most probably perish.

As soon as the young beets are 2 or 3 inches in height, thin them out well.

Beet, Silver.—This had best be raised in a seed-bed and the seedlings transplanted when they are large enough. Fresh manure may be used for silver beet and every encouragement for the speedy growth of the leaves, for this is the portion of the plant used, and not the root. Liquid manure will assist the development of the leaves very considerably if they are not making such satisfactory growth as is desirable.

Cabbage.—Keep up a sufficiency of young cabbage plants—just a few at a time—and prick out the seedlings in order that they may develop into strong and hardy plants before planting out in the garden. By keeping up a regular supply of plants in this manner the garden can be kept stocked with sufficient cabbages for use all the year round, and in most districts without cessation.

Cauliflowers.—These will, most probably, succeed best in gardens about the tableland, although if the present moist weather continues they should succeed in warmer places. Sow a little seed, prick out advanced plants, and plant strong young cauliflowers in garden. The cauliflowers and all the cabbage or Brassica class of plants need rich soil for best results, but avoid rank fresh manure.

Carrot.—This should grow well on land from which cabbage or cauliflowers have been removed. Sow a little seed from time to time, in order to keep up as constant a supply of this useful vegetable as possible. A little experience will soon teach how much seed it will be necessary to sow to do this. As there are numerous varieties of carrots, it would be as well to buy several kinds, as some may be preferred to others. The carrot is much affected by the eel-worm; in some soils where this pest abounds the carrots are disfigured and covered with knobs and swellings, and are unfit for use. The application of a large quantity of soot may

get rid of these pests, if all affected carrots and other roots are collected and burnt. But, unfortunately, it is a most difficult pest to deal with. If any particular part of the garden seems to be infested, avoid growing root-crops there.

Celery.—Keep up a little supply of plants by sowing small quantities of seed occasionally. Prick out advanced seedlings and plant out from prickings-out, according to requirements, in shallow trenches made in heavily-manured land. Celery that has grown almost to its full size may be blanched by covering the stems carefully from the light. This may be done by the aid of boards, drain-pipes, pea or bean haulm, or anything convenient that will keep out sunlight. The self-blanching kinds will be the best to grow.

The earthing-up of celery is laborious, and if it can be avoided by adopting some rule as suggested above, so much the better.

Cucumber should be growing well in the early or warm parts of the State, and even producing a good supply of young cucumbers. Seed may be sown if more plants are needed.

Cress and Mustard.—Sow seeds in just sufficient quantity for requirements. The soil should be well manured if it be not in good heart. The surface should be made quite fine before sowing the seeds.

Capsicum or Chili, sometimes known as "Peppers."—If plants have been raised from seed, plant out as many as may be needed, and but few should suffice. There are numerous varieties, from quite small and hot to enormous ones and mild. Some are very ornamental, and may be used effectively in the flower garden. Plants will grow almost anywhere and in any kind of soil in the warmer districts.

Egg-plant.—Mostly used here for ornamental purposes, for some of the varieties when bearing the fruits are extremely pretty. These fruits are largely used in some countries as vegetables, and are much liked. Plant out seedlings, and if necessary sow seed in box or seed-bed.

Kohl-rabi.—Sow a few seeds from time to time in seed-bed, and transplant and treat in much the same way as cabbage.

Leek.—Should always be grown, for it is a good, wholesome vegetable. It enjoys rich soil and abundance of manure. Sow a little seed and transplant seedlings to a shallow trench. When well grown blanch the stems before use.

Lettuce.—Sow a little seed and plant out advanced seedlings with some little care. If the soil be dry, water the plants well after planting. There are many varieties of the two great classes of lettuce—the Cos and the Cabbage—and it would be advisable to try some of each.

Melons, Rock and Water.—If a sufficient supply has not yet been sown, seeds may be planted at any time during the month. If the season continues as at present, the supply of melons is likely to be most satisfactory.

Okra.—Sow a little seed in box or seed-bed and plant out seedlings, when large enough to shift, about 2 feet apart.

Onion.—Sow a little seed in drills, and take care when the seedlings come up that weeds do not smother them. Before sowing the seed make the surface soil as fine as possible, and avoid covering the seeds over-deep with soil.

Parsnip.—Sow a little seed once or twice during the month. The ground for the parsnip should be trenched or dug deep, for it needs a deep free soil.

Peas.—Sow seed occasionally to keep up with the household demand. All pods should be gathered before the peas have become hard and ripening.

Potato.—A row or two should be planted, and any plants advancing should be well and frequently cultivated as long as possible.

Pumpkin.—Sow seeds if none have yet been sown.

Radish.—Sow a little seed now and then during the month to keep up required supply.

Tomato.—Sow seed; plant out seedlings from previous sowings.

Turnip.—A little seed may be sown occasionally.

Vegetable Marrow and Squash.—Seeds may be sown to any extent required. These are good, useful vegetables, and easy to grow.

Flowers.

October is or should be one of the best months of the year for flowers, and during the month the roses should be out in great perfection. Before it is too late remove all advancing shoots that are likely to cause too many branches and crowd up the heads of the plants, and remove any suckers that are growing up at the bases of the roses.

Tender annuals may be planted out all about the garden in almost any part of the State. Of these, balsams should be made good use of, also amaranths of all sorts, and these should make a magnificent display when they have fully developed the gay-coloured leaves or flowers.

Annual asters deserve attention also, and seed should be sown early in the month.

Farm Notes.

Hawkesbury District—October.

H. W. POTTS.

We are passing through a period similar in character to last year, and in many respects to that of the season of 1902. We have had 3 inches of rain, but quite insufficient to ensure adequate moisture for the subsoils throughout the season; in fact, in many places these are quite dry. The early crops have been brought into flower at a height of 9 to 15 inches; the hay crops, in consequence, must be light.

The weather for farming operations may be considered ideal. The surface soils are moist, in splendid sowing condition. The partial failure of the spring crops demands increased attention being devoted to quickly-growing summer crops. The frosts at present are light, and it is a fair risk to accept in sowing such crops that may suffer from late frosts.

The latter part of last month many farmers planted the first maize crop of the season, and this month may be fully occupied similarly. The Red Hogan variety has in the past invariably given such excellent results as a main crop that it may be considered the best at this period. Other varieties, such as Pride of the North, Early Mastodon, and Hickory King, may be recommended as good sorts for early grain. About 7 lb. of seed to the acre will be ample for the light loams, with 2 cwt. to the acre of fertiliser, equal parts of blood, bone, and superphosphates, of which half should be sown with the seed and the balance just before hilling.

The main crop of sorghums may be put in now. Both for green feed and ensilage, sorghum may be relied on for a heavy yield of valuable fodder. No other crop has in the past, in the presence of a dry summer, given such prolific and remunerative returns. The best variety for general purposes, and of the hardiest nature, is Planter's Friend; Early Amber-Cane and Sorghum saccharatum are also suitable. The possibility of a dry summer must be considered. It is best to sow in drills 3 feet apart, to enable shallow cultivation to be adopted during the early stages of growth. We have to remember that as a young plant sorghum requires much more attention than maize. At this stage it is more delicate, and is very susceptible to shortage of moisture and readily weakened by overgrowth of weeds. In the later stage, when developed, the reverse is the case; sorghum then will stand more hardships than maize.

Millets.—These may now be sown with greater confidence. Continued sowings may be made of the quickly-growing fodder varieties White French and Hungarian. In each case the results will be enhanced by having a well-tilled soil enriched with farmyard manure. In the absence of this a complete fertiliser may be substituted. It is found on light soils that 7 lb. of seed to the acre is sufficient, sown broadcast. With moderate rains and absence of frost in the early growth, a succulent and palatable crop may be taken off in about sixty-five days. Japanese, New Siberian, and Salzer's Dakota are also varieties worthy of trial.

Broom Millet.—This crop is steadily growing in favour with many farmers who have been testing its value in the past on a small scale. Where the land is fairly rich, especially on alluvial flats, the crop pays well. Much, however, depends on the intelligence and attention devoted to the selection of seed, cultivation, curing, and baling of the crop to assure good prices. In order to assist growers, a pamphlet was issued by the Department of Agriculture last year, written by our experimentalist, Mr. Marks. This contains a mass of detail relating to the various phases of broom millet production, which should be perused carefully. It will be forwarded to any grower on application to the Department of Agriculture, Sydney. The first of three sowings may be made this month. The early-sown crop almost invariably provides the best returns. Sowings may be continued at periods of two and three weeks apart.

Mangolds and Sugar Beets may be sown during the early part of the month. Experiments have shown that seed soaked for twelve hours gives a more certain germination and a more sturdy plant. Where the soil is rich and deep the Mammoth Long Red Mangold is a more certain cropper. In light shallow soils the Yellow Globe will give the best yield. In each case use 5 to 6 lb. of seed to the acre.

Sweet Potatoes.—There is an increasing interest being shown in the cultivation of this edible tuber, and it is becoming more popular as a food for family use. Light sandy and loamy soils provide the best conditions for its rapid growth. The sweetness and flavour of the sweet potato develops best during hot dry summers and under conditions invariably adverse to other crops. The best fertiliser is potash, either in the form of sulphate or wood-ashes with superphosphate. This month the young plants may be planted out, and will be better soaked first in a thick mulch of cow-dung. Plant about 15 inches apart.

Pumpkins, Marrows, Squashes, and Melons.—The main crops may be sown at once. Whilst we are dependent on favourable moisture conditions, yet the returns, if we get a favourable season, are so highly satisfactory that we cannot afford to lose any chance of a crop. In all sections of stock-feeding these useful adjuncts to dry feed cannot be over-estimated. The large or cattle varieties, such as Pot-iron Squash, which provide pumpkins weighing from 60 to 70 lb., with a minimum of

moisture and with good keeping qualities, are most useful for storage and winter use. The Crown, Rio, and Ironbark sorts can be used also for household purposes. Good table pumpkins always keep well and realise payable prices.

Cowpeas.—These take the place of other leguminous crops which fail to grow in our light soils and under such warm conditions of climate. Every season evidences the increasing favour in which this splendid fodder is being entertained by our farmers. Its dual capacity is being more freely realised as a grazing crop for stock and as a subsoil renovator, and its importance in the rotation in adding humus to the soil and increasing its fertility, as well as improving its texture. Wherever cowpeas are grown the moisture-retaining capacity of the soil is improved. In light sandy loams no plant can be grown with greater advantage. Like the sweet potato, it does best during the prevalence of hot weather, and provides a relishable, succulent green forage for stock at a period when green feed is scarce. The soil should be brought to a fine tilth. Plant the cowpeas in drills 3 feet apart and the seed 6 to 8 inches apart in the drills. 8 lb. to 10 lb. to the acre will be sufficient. A maize drill can be used to plant, with a plate having ⅜-inch holes. Cultivation must be practised once a fortnight following, until the vines are well forward and spread.

The varieties best suited for forage are Black, Whip-poor-Will, Clay-coloured, White, Warren's Hybrid, Chinese Mottled, and Red Ripper.

Bathurst District—October.

R. W. PEACOCK.

Maize.—The Bathurst district, owing to its many dry summers, can hardly be termed a maize district, yet very creditable and profitable crops are sometimes harvested. The growing season, from spring frosts to autumn frosts, is not a long one, and only early maturing varieties should be sown. Riley's Favourite, Hickory King, and Golden Beauty are suitable varieties.

The frequent cultivations necessary for the proper growth of maize brings the soil into a desirable state of tilth for wheat or oat crops, and by sowing early varieties the land can be got ready for the growth of these cereals. Maize should be planted early in the month. It should also be sown for green fodder for sheep, cattle, and pigs, it being a safe and much relished summer fodder.

Potatoes.—The planting of these for the early crop should be expedited, and the land already planted should be harrowed before they appear above ground, which kills most of the young weeds and conserves the moisture.

Sorghums and *millets*, *mangolds*, *field carrots*, *Jerusalem artichokes*, and *pumpkins* may be sown.

Cowpeas may be sown for green fodder—sheep and pigs—or for green manuring. They withstand a lot of dry weather upon well-prepared soil. They are valuable in a rotation.

Lucerne.—The first cut should be ready to come off about the end of the month. If much grass and other weeds are induced by the favourable season, it would be preferable to turn the first cut into ensilage. This can be made in bad weather, and as the season is usually broken during this month it is difficult to make hay. By cutting early, the next cut, which would be clean, could be harvested earlier. Green lucerne packs together readily, and may be ensilaged in the stack.

Vegetable Garden.—Sow carrots, parsnips, melons, pumpkins, cucumbers, squashes, sweet corn, French, butter, and Lima beans, and white turnips. Make small sowings of peas. Sow in seed-beds cabbage and lettuce. Transplant cabbage, lettuce, tomatoes, chillies, egg plants, and Cape gooseberries.

Glen Innes District—October.

R. H. GENNYS.

Grasses and Fodder Plants.—It is getting late for artificial grasses, clovers, and lucerne, but these may still be sown on very clean land, their success will almost entirely depend on plenty of moisture for the following three months. Cover seed at a shallow depth and sow thickly at this time of the year. Grasses likely to succeed best on the table-lands are Perennial Rye Grass, Kentucky Blue Grass, Cocksfoot, Prairie, and Timothy. Red Clover does well, and may be sown with the grasses for a permanent pasture. Cow-grass, a species of Red Clover, has done very well here.

Maize should be planted this month. Iowa Silvermine has proved itself a very useful sort for New England, as it matures early, has a deep grain, small core, a good cropper, and does not grow too much stalk. Plant kernels from good well-shaped cobs, selected if possible from short stalks that have borne more than one cob. The grain from any portion of the cob will do: but if very small, the end of the cob might be broken off and put on one side. In heavy, damp land it is better to plant half-way up on the off side of the furrow, as if heavy rain comes this may save planting over again.

Potatoes.—Sow some early varieties. Early Rose, Cambridge Kidney, and Ashleaf Kidney are among the best here. The main crop is better planted a month or six weeks later. Very small seed should be

avoided, and is better boiled and fed to pigs. Sow either fair-sized whole tubers or large tubers cut into two or more sets; these latter should have a weight of not less than 2 oz. each, with two or more eyes—the weight being of more importance than the number of eyes. Do not cut too long before planting, and dust the seed with fine wood-ashes or some other powdery substance to prevent much bleeding. Choose the lighter reddish soils if possible for potatoes. Heavy clays, and especially badly-drained land, should be avoided. In such a wet climate as New England, I am of opinion it is better to hill potatoes and plant at a fair depth; the hollow left between the rows acts as a drain and the tubers are left on the higher ground.

For prevention of Scab.—Formalin may be used in the proportions—1 oz. commercial formalin (liquid) to 2 gallons of water. Soak potatoes for two hours, then cut and plant in usual way.

Sow *Millets, Sorghums,* and the like. Hungarian and New Siberian are good hay sorts in the millets. White Italian for broom-making does well here. Of the sorghums, Amber-Cane and Planter's Friend are two of the best. Kaffir Corn also does well.

Pumpkins and Melons.—Sow all kinds of pumpkins. Grammas are good stock feed, and do well on the heavy land. French Mammoth grows to a great size. For eating sorts, Ironbark, Crown, and Button pumpkins are among the best.

Among *Squashes,* Hubbards do remarkably well, and are worth cultivating; they are such good keepers, and a fine table-vegetable at all times. *Melons.*—Both Cuban Queen and Cassabah are good-eating sorts that do well here.

Sow all kinds of spring vegetables, as danger from frosts should be pretty well over.

Clarence River District—October.

T. WALDEN HANMER.

We are being blest with a beautiful spring! Showery weather has prevailed since about the middle of August, and the district has not worn such a smiling countenance at this time of the year for a very long time.

Maize.—Planting maize on the low-lying lands has in some instances to be delayed in consequence of the land being too wet and cold, but where the soil is in good heart, planting should be proceeded with as rapidly as possible. The best way to plant maize is to drop single seeds every 12 or 16 inches apart, according to the strength of the soil, in the rows, and have the rows 3 feet to 4 feet apart. The cultivator should, of course, be kept going as long as possible between the rows.

Sugar-cane.—Crushing is in full swing at the Harwood mill. Those who desire to grow cane, either for sugar or stock-feeding purposes, should plant this month if the weather be favourable. The varieties favoured by the Colonial Sugar Refining Company are Iduria, Mauritius Ribbon, and Louzier.

Sorghum.—October is one of the best months to plant this valuable fodder plant, and Amber-Cane and Planter's Friend are the best varieties. We prefer this plant broadcasted, at the rate of about 18 lb. per acre, as the stalk does not grow so rank and the cattle eat it up clean, whereas if grown in drills the stalk usually is very coarse and the cows simply eat off the leaves and tassel and leave the rest to waste.

Teosinte.—We are trying about an acre of this heavy-yielding plant. It is a tropical plant, and should prove itself a valuable addition to our list of "green stuff." I saw some of it growing at the Government Stud Farm, Berry, last season, where, considering the trying season, it yielded very well. Records of it yielding up to 26 tons per acre have been noted, and when about 4 feet high it gives three or four cuttings. It should be planted in rows 4 feet apart, and two seeds should be dropped every 2 feet apart in the rows. Particulars as to how it thrives at Grafton Farm will be published in the *Gazette* after we have tried it.

Potatoes.—These will require scuffling and hilling during this month. There is no occasion to make the hills too high; the earth should be thrown just high enough to keep the top tubers from becoming sunburnt.

Sow also this month broom millet, pumpkins, squashes, melons, grammas, and buckwheat.

In the vegetable garden sow French and butter beans, peas, cabbage, lettuce, carrots, parsnips, turnips, and plant out tomatoes.

Banana and pine-apple suckers may be planted this month. The young shoots of grape-vines should be tied up to prevent the wind breaking them, and the vines sprayed occasionally with Bordeaux mixture, compounded according to Dr. Halsted's formula, as follows:—4 lb. bluestone, 4 lb. quick-lime, 50 gallons water.

Cotton and tobacco may also be planted this month.

Don't Use Soap in Washing Milk Vessels.

THERE is a decided objection, says H. E. Van Norman, of Purdee University, in the "Country Gentleman," to the use of any common washing or laundry soaps for washing milk vessels. As an illustration, at a recent dairy convention the judge, in criticising a certain lot of butter, noted on the score-card, "Tastes of soap." Inquiry of the exhibitor later brought out that in her anxiety to have everything right, she had given the vessel a thorough washing with soap suds, and had carefully rinsed it afterward; yet there was sufficient soap adhering to the vessel in which the milk had been handled so that the judge could detect it in the butter. While I grant that this was a good judge, with a very sensitive taste, this experience has often been confirmed. I would recommend the use of sal soda, or some other alkaline washing powder, and suggest the following as a desirable method in the absence of steam, or with steam in addition, for that matter:—

As soon as the vessels are emptied, rinse them out with lukewarm water, if available; if not, cold water. Wash thoroughly in water as warm as can be comfortably worked in, using sufficient alkaline washing powder to cut the grease. Then rinse in boiling water, or as near it as possible. It would be a little better to use two waters, one to rinse the alkaline water off and the second to simply scald it. In ordinary practical work, this is more trouble than most people will take, so that one rinsing with sufficient water is reasonably satisfactory. This vessel should then be turned up to drain and dry. If left hot, it should dry without rusting.

In dairy practice we recommend the use of a brush while washing, and then not wiping the tinware with a towel. Experiments performed in our laboratory with tinware which was steamed, steamed and wiped with a new towel that had never been used, wiping with a so-called clean used towel and with a soiled towel, showed that after wiping with a new cloth there were three and a half times as many bacteria left on the surface as in the case where it was steamed only; after wiping with a used towel, one which any house-wife or dairymaid would call a "clean towel," there were 300 times as many as when steamed only; and after using a soiled towel, one which was not worse than is commonly used in the kitchen for our dinner plates or our dairy utensils, it showed 4,000 times as many as when steamed only. Tinware scalded with boiling water or live steam will be bacteriologically cleaner, but not so bright as if polished with a cloth.

Crown Lands of New South Wales.

THE following areas will be available for selection on and after the dates mentioned:—

FOR ORIGINAL SETTLEMENT LEASE ONLY—(Available under Section 25 of Act of 1895. Regulations 148 to 157D. Applications to be made on Form 50).

S.L. No.	Name of Land District	Total Area.	No. of Farms.	Area of Farms.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
		acres.		acres.		£ s. d.	1906.
843	Tenterfield ..	33,700	8	3,500 to 6,000	Stanthorpe (Q.), 22 to 37 miles; Tenterfield (N.S.W.), 37 to 40 miles.	29 3 4 to 50 0 0	11 Oct.

From flat and undulating to broken and rough mountainous country; loamy, sandy, gravelly, and rocky soil of granite, altered slate, and basaltic formations; the greater part is moderately thickly timbered with oak, gum, box, apple, stringybark, ironbark, bloodwood, swamp oak, pine, cedar, and dogwood, also some grasstree, patches of scrub, and patches of open forest. Average annual rainfall, 37·27 inches at Rivertree. There are no rabbits, scrub wallaby are thick in places, and dingoes are troublesome. Public school at Rivertree, from about 1 to 8 miles distant. Water supply ample and permanent.

FOR ORIGINAL CONDITIONAL PURCHASE ONLY—(Classified under Subsection 1 (A), Section 4, of Crown Lands Amendment Act, 1905; available under Section 26 of Act of 1884. Regulations 74 to 130. Application and declaration to be made on Forms 21 and 22).

Name of Land District.	Name of Holding, &c.	Parish.	County.	Total Area.	Price per Acre.	Date available.
				a. r. p.	£ s. d.	1906.
Grenfell*	....	Eualdie	Forbes ..	634 3 0	1 10 0	18 Oct.
Suitable for grazing and agriculture.						
Tamworth ..	....	Ainsley and Loftus	Parry ..	2,370 0 0	1 0 0	15 Nov.
Suitable for grazing.						

* Identical with special area (see page 1073).

G

For Original Conditional Purchase and Conditional Lease in virtue thereof—(Classified under Subsection 1 (b), Section 4, of Crown Lands Amendment Act, 1905; available under Sections 26 and 48 of Act of 1884. Regulations 74 to 130. Application and declaration for Original Conditional Purchase to be made on Forms 21 and 22, and for Conditional Lease on Forms 95 and 96).

Name of Land District.	Name of Holding, &c.	Parish.	County.	Total Area.	Price per Acre.	Date available.
				a. r. p.	£ s. d.	1906.
Bombala ..	....	Tangaroo and Mount Trooper.	Wellesley ..	3,840 0 0	0 8 4	11 Oct.
Suitable for grazing, and is intersected by Sheep-station Creek						
Carcoar	....	Bracebridge ..	Bathurst ..	392 0 0	1 0 0	1 Nov.
Suitable for grazing.						
Coonabarabran	Caigan	Cuttabuloo . ..	Gowen ..	134 3 0	1 1 0	22 Nov.
Suitable for grazing and agriculture.						
Cootamundra ..	....	Hurley	Clarendon	261 3 0	1 15 0	15 Nov
Suitable for grazing and agriculture.						
Dubbo	Cobranraguy ..	Medway and Cobranraguy.	Lincoln ..	2,150 0	0 10 0	18 Oct.
Suitable for grazing.						
Grenfell	Lower Balabla ..	Eurabba . ..	Bland ..	780 0 0	1 0 0	22 Nov.
Suitable for grazing and agriculture.						
Molong	....	Moura	Ashburnham	240 0 0	0 10 0	11 Oct.
Suitable for grazing.						
Parkes .. .	....	Nelungalong ..	Ashburnham	388 0 0	0 18 4	25 Oct.
Suitable for grazing and agriculture.						
Parkes ..	....	Nelungalong ..	Ashburnham	260 0 0	1 5 0	25 Oct.
Suitable for grazing and agriculture.						
Parkes .. .	....	Warregal	Ashburnham	200 0 0	1 5 0	25 Oct.
Suitable for grazing and agriculture.						
Rylstone .	....	Coolcalwin and Growee.	Phillip ..	640 0 0	0 13 4	25 Oct.
Suitable for grazing.						
Tumut	....	Batlow . ..	Wynyard ..	160 0 0	0 15 0	25 Oct.
On Stockman's Creek. Suitable for orchards and cultivation.						
Urana .. .	Bulgandra ..	Bulgandry .. .	Hume ..	320 0 0	1 15 0	25 Oct.
Being portion 120. Suitable for grazing and agriculture						
Urana .. .	....	Mahonga Forest ..	Hume ..	300 0 0	2 5 0	22 Nov.
On Billabong Creek. Good agricultural land.						

CONDITIONAL PURCHASE (ORIGINAL OR ADDITIONAL) OR CONDITIONAL LEASE—(Available by revocation of reserves, and not classified or specially set apart under Section 4 of the Crown Lands Amendment Act of 1905; available under Sections 26, 42, and 48 of Act of 1884. Regulations 74 to 130. Application and declaration for Original Conditional Purchase to be made on Forms 21 and 22, and for Additional Conditional Purchase or Conditional Lease on Forms 95 and 96).

Name of Land District.	Name of Holding, &c.	Parish.	County.	Total Area.	Price per Acre.	Date available.
				a. r. p.	£ s. d.	1906.
Grafton	....	Copmanhurst ..	Clarence ..	92 0 0	1 0 0	1 Nov.
The adjacent lands at back of this area are also available at £1 per acre.						
Port Macquarie..	....	Koree	Macquarie ..	40 0 0	1 0 0	25 Oct.
Grazing land.						

CONDITIONAL PURCHASE AS SPECIAL AREA.

Grenfell Land District, 634¾ acres, in parish of Eualdrie, county of Forbes, maximum area 274 acres, minimum area 91 acres, distant 5½ miles to 8 miles from Grenfell; suitable for grazing and agriculture; price £1 10s. per acre. Available for original applications only on 18th October, 1906.

FOR IMPROVEMENT LEASE—(Available under Section 26 of Act of 1895. Regulations 157 E to 160 and 250 to 262 A. Tender to be made on Form 74. If not tendered for within time advertised may be subsequently applied for on Form 91).

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Upset Annual Rental per Block.	Date of Sale or Tender.
	EASTERN DIVISION.						
			acres.		acres.	£ s. d.	1906. Sale.
638	Braidwood .. .	....	.... ..	1	327 (ex roads).	4 1 9	8 Oct.

For the most part extremely poor, consisting of slate hills; timbered with stringybark, brittle gum, and peppermint, with flats of about 20 acres along the rivers timbered with gum and a little tea-tree and wattle; the water in the rivers is permanent; situated about 23 miles south-easterly from Tarago Railway Station, and about 16 miles north-easterly from town of Braidwood.

641	Inverell	Pindari	... .	1	1,400	5 16 8	Sale. 8 Oct.

Broken and rough rocky ridges and hills, with numerous watercourses; volcanic and granite formations; trappean rock outcrops; timbered with gum, ironbark, stringybark, and pine, with pine and tea-tree scrubs; sound breeding country when ringbarked and cleared; generally poor, rocky, stony, and sandy grey soils; rock subsoil; water supply sufficient in Dingo Creek. Rainfall about 32 inches per annum. Rabbits exist. Situated about 27 miles from Inverell Railway Station.

644	Mudgee	....	....	1	7,400	23 2 6	Sale. 15 Oct.

Sandstone ridges; rocky; lines of cliffs in places; ridges; flat tops; very sandy; some open gullies and slopes; soil very sandy and poor, mostly timbered with thick forest of ironbark, gum, stringybark, apple, pine, and some box; parts scrubby and largely covered with dwarf tea-tree. A few small springs exist, and would be improved by opening out—a small expense only. Conservation could be effected by dams. Rainfall about 30 inches per annum. Rabbits exist. Situated about 30 miles from Cassilis, and about 55 miles from Mudgee Railway Station.

640	Tenterfield	Mole River	......	1	600	5 0 0	Sale. 8 Oct.

Gently undulating land of granitic formation; soil sandy loam, stony and rocky, cement and rocky subsoil; timber—box, gum, apple, forest oak, dogwood; about 80 acres of dead-finish and undergrowth; water practically permanent and sufficient in Silent Grove Creek. Rainfall about 33 inches per annum. Wallabies are numerous, and dingoes are troublesome. Situated about 28 miles north-westerly from Deepwater Railway Station.

	CENTRAL DIVISION.						
					acres.		1906. Sale.
1434	Warren..	Carwell	....	1	5,800	77 8 10	15 Oct.

Half red loam and red sandy loam, part chocolate loam, and remainder black clay loam; crab-holey country; half open box and box and myall, half dense box, budtha, pine, yarran, oak and wilga; scrubs of scattered pine, budtha, and wattle on about half the area, and a strip of dense gum seedlings. The land has frontage to Marthaguy and Back Creeks—not permanent, but they afford good facilities for conserving water. Average annual rainfall, about 20 inches. Rabbits are very numerous. Situated about 6 to 9 miles from Quambone, about 50 miles from Warren Railway Station, and about 45 miles from Coonamble Railway Station.

AGRICULTURAL SOCIETIES' SHOWS.

1906.

Society.	Secretary.	Date.
Adelong P. and A. Association	J. J. McAlister	Oct. 2, 3
Lismore A. and I. Society	T. M. Hewitt	Oct. 31 & Nov. 1

1907.

Albion Park A., H., and I. Society	H. Fryer	Jan. 16, 17
Kiama Agricultural Association	James Somerville	,, 26, 28
Berry Agricultural Association	A. J. Colley	,, 30, 31, Feb. 1, 2.
Wollongong A., H., and I. Association	J. A. Beatson	Feb. 7, 8, 9
Shoalhaven A. & H. Association, Nowra	W. Randall	,, 13, 14
Moruya A. and P. Society	John Jeffery	,, 13, 14
Kangaroo Valley A. and H. Association	E. G. Williams	,, 21, 22
Alstonville Agricultural Society	W. W. Monaghan	,, 27, 28
Tenterfield Intercolonial P., A., and Mining Society	F. W. Hoskin	Mar. 5, 6, 7
Braidwood	L. Chapman	,, 6, 7
Berrima A. H. and I. Society	J. Cullen	,, 7, 8, 9
Blayney A. and P. Association	H. R. Woolley	,, 12, 13
Gundagai P. and H. Society	A. Elworthy	,, 12, 13
Central New England P. and A. Assoct'n, Glen Innes	Geo. A. Priest	,, 12, 13, 14
Warialda P. and A. Association	W. B. Geddes	,, 13, 14, 15
Goulburn A., P., and H. Society	J. J. Roberts	,, 14, 15, 16
Newcastle A., H., and I. Association	Owen Gilbert	,, 14, 15, 16
Armidale and New England P., A., and H. Associat'n	A. McArthur	,, 19, 20, 21, and 22
Camden A., H., and I. Association	C. A. Thompson	,, 20, 21, 22
Inverell P. and A. Society	J. McIlveen	,, 20, 21, 22
Mudgee Agricultural Society	J. M. Cox	,, 20, 21, 22
Crookwell A., P., and H. Association	C. T. Clifton	,, 21, 22
Upper Hunter P. and H. Association, Muswellbrook	Pierce Healey	,, 21, 22, 23
Walcha P. and A. Association	S. Hargrave	,, 27, 28
Robertson A. and H. Society	R. G. Ferguson	Feb. 28, Mar. 1
Royal Agricultural Society of New South Wales	H. M. Somer	Mar. 26 to April 3
Orange A. and P. Association	W. Tanner	April 10, 11, 12
Bathurst A., H., and P. Association	W. G. Thompson	,, 17, 18, 19
Durham A. and H. Association (Dungog)	C. E. Grant	,, 24, 25
Richmond River A., H., and P. Society (Casino)	E. J. Robinson	,, 24, 25
Macleay A., H., and I. Association, Kempsey	Ernest Weeks	,, 24, 25, 26
Clarence P. and H. Society, Grafton	T. T. Bawden	,, 30, May 1, 2
Central Australian P. and A. Association (Bourke)	G. W. Tull	May 22, 23

[3 plates.]

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Agricultural Gazette of New South Wales.

Forestry.

SOME PRACTICAL NOTES ON FORESTRY SUITABLE FOR NEW SOUTH WALES.

[Continued from page 989.]

J. H. MAIDEN,
Government Botanist and Director of the Botanic Gardens, Sydney.

XVI—*continued.*

The Sand-drift Problem in New South Wales.

II. THE WESTERN PROBLEM.

IN dealing with the coastal drifting sands, the relation of cause and effect is very obvious; in dealing with the interior sands, their dire effects are very obvious, although their causes and source are less clear. It is with the view of drawing attention to the paucity of information in regard to the causes of our Western Sand-drifts and of endeavouring to outline a method of dealing with them on scientific principles that the present paper is submitted.

Travelling Sand, near Milparinka.

(From a photograph by Mr. C. J. McMaster, President, Western Lands Commission.)

1. Report of the Western Lands Commission, &c.

The report of the Western Lands Commission* is a cyclopædia of information in regard to the condition of the far western portion of this State. A note on sandstorms is given at page 8 with references to the evidence of witnesses on the subject. Two remarkable photographs are reproduced, one showing denudation, 3 feet of soil having been removed from the roots of a tree by the attrition of sand set in motion by wind, and the other showing the sand piled up against a station homestead.

House in progress of burial by Sand-drift, Cobhan Lake Homestead.
(From a photograph by Mr. C. J. McMaster, President, Western Lands Commission.)

Let me invite your attention to a paper by Mr. C. A. Benbow, entitled "Interior Land Changes."† Mr. Benbow also delivered a lecture upon "Drifting sands of the west of New South Wales," on the 30th April, 1903. He did not publish on that occasion, but he presented many facts well worthy of attention by citizens of this State.

Drifting sands have overwhelmed many a fair city, a fact with which every student of history and geography is familiar. By attending only to present requirements people have, by means of their flocks and herds, denuded the

* Western Division of New South Wales, Royal Commission to inquire into the condition of the Crown Tenants, Parts I and II, 1901. Printed by order of the Legislative Assembly.

† *Agric. Gazette, N.S.W.*, October, 1901.

vegetation which naturally more or less fixes the soil, and to obtain fuel and timber they have cut down the shrubs and trees, either recklessly or without replacing them by younger growth; they have not guarded against forest or prairie fires, or when these have taken place, have not taken adequate steps to repair the damage. The devastations of war have added to the general destruction. By degrees, perhaps during a period extending over centuries,

Tree left in the air by reason of the soil being blown away.

Mulga-tree on Yantara (north-west corner of N.S.W.); 3 feet of the surface soil blown away.
(From a photograph obtained by Mr. C. J. McMaster.)

the carefully adjusted "balance of nature" has been so disturbed that desert sands have encroached on agricultural lands and have overwhelmed villages and even large cities, the cumulative results of neglect being of such magnitude that the resources of the inhabitants have at length been insufficient to cope with them. All these catastrophes are gradual, and if they be studied, and the principles they can teach us be properly understood, then the first step with the view of combating them will have been gained.

In my paper, "Forests in their relation to Rainfall,"* I have produced conclusive evidence to show that uncontrolled destruction of trees may be attended with most disastrous consequences to any country, and in my paper, "Mitigation of Floods in the Hunter River,"† I have endeavoured also to arrive at the first principles which result in mighty consequences.

As regards the sad state of our Western lands, which has inflicted untold misery on domestic animals and on lion-hearted humanity, am I not justified when I say that inquiries into the subject are usually too much taken up with a sad catalogue of privations and catastrophes, and that too little attention is given to directing the rays of science upon the ultimate causes of the existing state of things? Are we not in the position of an anxious physician who is trying to cope with an obscure disease: he must apply his remedies more or less empirically? But, nowadays, medical men are trying to get at the origin of disease, at the pathogenic organism that causes it, at the conditions which promote its growth or retard its development, and treatment and preventive steps are based upon knowledge as far removed from empiricism as possible.

As regards the bacillus of the drifting sands of the interior, Heaven preserve me from the presumption that I have discovered it, or that I am able to suggest a wholly satisfactory remedy; but if the scientific men of this State will give attention to the subject, and systematically make observations and collect data, I do not doubt that the drifting sands of New South Wales will be kept under control.

2. Area of Sand-drift Country.

The sand-drift country extends in its greatest intensity from our western boundary to the Darling. To a lesser degree it includes most of the Cretaceous and Cainozoic territory of our geological maps. Reference may be made to the Vegetation Zones Map of New South Wales published by me in the June issue of the *Gazette*. Much of the country marked 6 in that map is liable to sand-drifts.

3. Classification of Western Soils.

The Western country may be divided into three classes:—

(*a*) The black earthy plains (the "black-soil plains") which crack when dry, but which do not move.

(*b*) Soil with more or less clay in it; this may blow away, but it does not drift. Much of this country is subject to inundation during high floods.

(*c*) Drifting sands. The soil is composed of clay, vegetable matter, and sand. The lighter component parts blow away during seasons of extreme drought when the surface is denuded of vegetation. The remaining sands—mostly red in colour, but sometimes white—are the drifting sands of the west.

* See Part XV of this series (*Gazette*, September, 1906).
† See Part IX (*Gazette*, June, 1905).

4. Geological Origin of the Moving Sand.

Where does it originate? In Central Australia, extending further towards the west than towards the east of the continent. As far as our own State is concerned, the Barrier and Grey Ranges arrest the great bulk of the sand tending to come from South Australia, and the Murray River performs a similar service in regard to the desert country in Victoria. In other words, our trouble has originated within our own borders. Between the Barrier Range and the Darling River there are tracts of sand-hills and undulating sandy country which have been well grassed (the term is comparative) and clothed with vegetation. The vegetation being eaten out, the soil would drift, particularly in seasons of drought. In other words, much of the trans-Darling country is in a state of unstable equilibrium.

The consensus of evidence shows that the sand moves more than it used to do. What prevented this? Simply the vegetation, sparse though it was, which through a long course of ages had tended to knit it together. In fact, in sandy country, all that binds it together is vegetation.

I presume that the drift sand is the product of the denudation or of the disintegration of the Desert Sandstone, but the origin is probably well known to geologists, who have chemical and other data in regard to it. At all events, it is not rich in the elements which go to promote plant life.

However, the actual origin of the sand appears to be a mystery. Mr. H. Y. L. Brown, Government Geologist of South Australia, attributes the origin of much of it to the action of artesian water.

5. Causes of drifting sands.

To summarise in some degree, three causes have resulted in drifting sands :—

(a) Droughts.

Some authorities even aver that sands did not, in the old days, drift except in droughts. This is not correct, but they are more mobile now.

In the Western country, much depends on the infrequent rains, especially upon the times at which they fall. Rain at a critical period will secure the germination and development of certain plants; if rain be withheld, a particular kind of plant will die out, at least for a period, in spite of a fall of rain at some other period of the year. It is assumed that each plant has a critical period on which its development depends, and the appearance of countless millions of, say, thistles at one time over a given area, and the disappearance of the same for a term of years, is attributed to the timely combination of rain and genial warmth in the one case and in their absence in the other. In western plantings much depends upon this fortuitous rainfall. If it comes, the success of the venture may be assured; if it be withheld, its success is problematical. It is this element of uncertainty which obtrudes itself into western operations that renders dealing with this part of the country so very difficult.

(b) Overstocking.

It is very easy to criticise the pastoralist for overstocking, but there are so many variables to be considered in obtaining the constant as regards the carrying capacity in a particular year, that most of the overstocking is unavoidable, the result of our ignorance of the sequence of the seasons. The mechanical action of a flock of sheep, irrespective of overstocking, is important. They pulverise the soil, and for many years, and in dry times, the position of a flock of sheep has been readily detected in the distance by an attendant cloud of dust.

(c) The rabbit pest.

This is the real cause of overstocking, and it is involuntary on the part of the pastoralist. This pest has become acute during the past twenty years, and has accentuated any overstocking by sheep.

6. Prevailing Winds.

Mr. Russell told me that the prevailing winds in the Western country, capable of piling sand, vary from north-west to south-east. According to the preponderance and strength of these winds, so will the direction of the sand-ridges vary. It will, of course, be borne in mind that the direction of the ridges will be at right angles to the prevailing wind.

Mr. A. W. Howitt is of opinion that the strongest winds in the Lake Eyre district of South Australia are south-west.

According to Mr. R. Helms, the prevailing direction of sand-dunes is east and west, and they are rarely more than half a mile apart.

See a valuable paper by Colin J. McMaster, Chief Commissioner of Western Lands,* where the author points out that the sand-dust is travelling eastward :—

> That the imperceptible eastward trend of the sands has not been specially marked in the past is not sufficient ground for assuming that an equally slow rate of progress will take place in the future, because, up to within recent years, the land was more or less covered with vegetation ; but now, to an alarming extent, vegetable growth of all kinds has disappeared, and in the future the sands may drift in every dry season, instead of during periods of prolonged and excessive drought, such as this State has recently passed through.

This paper contains also interesting sections of levels across sand-hill shifting north-easterly under the influence of south-westerly drought winds, county of Landsborough, Western Division, New South Wales.

7. Remedial Measures.

Since our knowledge of the inland drifting sands is so sparse, with such defective knowledge, I am afraid our remedial measures must be largely tentative. Having learnt the principle of arresting the progress of a coast sand-dune from its source and coping with it, we should endeavour, as far as possible, to apply a similar principle to the inland ones also. In dealing with the latter, a large *area* of moving sand may be the *source ;* hence we must

* *Proc. Roy. Soc. N.S.W.*, Vol. XXXVII, 138 (1903).

modify our tactics, forming a number of more or less parallel lines of defence at a comparatively great distance apart, instead of practically one line of defence, as with the narrower strips of sand on our coast.

I think that *conservation of vegetation* should be our watchword; I would subordinate planting to this. An essential condition to success is to keep stock off areas which are being conserved or planted, perhaps for a considerable period. Close planting is necessary, otherwise weeds and grasses compete unduly with the young plants, which can be thinned out as necessity arises. The remarks I have made in regard to the utilisation of the native vegetation, when speaking of the coast dunes, I would particularly emphasise in speaking of those of the interior. I do not propose to exclude exotic plants; but I have no hesitation in saying that the bulk of the work of sand-binding in the interior must devolve on Australian indigenous plants.

(*a*) *Method of Planting.**

I am aware that, on the ground of expense, methods of protection against sand in Western areas can only be applied for the protection of buildings, gardens, and other limited areas of special value. To begin with, one must, in many cases, have a nearly smooth surface of sand, and this must be locally protected with a wattle fence † constructed of bundles of any plant rubbish that can be spared, packed on the windward side. The surface of the sand must then be protected with branches of any kind, pegged down as far as possible. Areas thus protected should each be a few hundred feet long and, say, 50 feet broad, the greater length being at right angles to the prevailing wind. This protected area should be sown with seeds of the indigenous vegetation, and, as in the case of the coast dunes, the fixation of one area would protect a second area which would be similarly treated, and so on.

Where homesteads are in danger of being overwhelmed by sand I would certainly try Marram Grass, although its value in localities away from the sea has not been tested. The Western sands often contain more or less saline matter, and it is hoped that a good test of Marram Grass may be made at no distant date. Better get the grass started and acclimatised while the seasons are moderately good, without waiting for the increased difficulties inseparable from a spell of drought.

(*b*) *The planting of experimental areas suggested.*

In order to give my suggestions a trial, certain experimental areas could be set apart by the Western Land Board. In the meantime maps could be prepared of the Western areas, carefully indicating the shifting sands; then

* In *Agric. Gazette, N.S.W.*, February, 1904 (p. 139), is a translated article "The planting of sandy plains (in Russia) to prevent drifting," but the value of that article for us is discounted by the fact that, in some of the instances quoted, we do not know whether coastal or inland areas are referred to, and the botanical names of the plants recommended are not given, and therefore uncertain. The Sand Willow referred to is *Salix acutifolia*.

† In using this term in Australia, one must remember that the term Wattle has the accidental meaning of Acacia with us. A wattle fence is really a fence of thin or split saplings.

depôts could be established in various districts, each depôt being in touch with an experimental area or group of such areas. Each depôt should be in charge of a skilled gardener, a really good man,—and we have many such in this State. While he is making his plans for the levelling and sowing of the experimental areas, he would carefully collect seeds of the different kinds of vegetation found in the district, and carefully preserve them as gardeners know how. Then at any time judged to be desirable, he could make his sowings.

He could also, if deemed desirable, establish at each nursery a small experimental nursery. Probably his trees, &c., would have to be raised by the "bamboo method," as flower-pots would be out of the question, and other receptacles (tins for jam, fish, meat, &c.) would be comparatively few. And here I may make the observation that in the afforestation of the Western country old tins would be valuable, and these articles should, as far as possible, be carefully preserved for this purpose instead of being thrown out as at present.

The gardener-in-charge of each depôt would also encourage the native grasses and other tussocky and creeping stemmed plants to spread. He would plant cuttings of salt-bush and other plants. The work of one gardener would be compared with that of another, and they should be encouraged to emulate each other. A good gardener (and let me say that we must have trained men, and not mere labourers, however willing) would master the planting of any sand-dune. He would also be a focus of information for a district, instructing anyone who might seek knowledge. By degrees, under the lee of the sand-dunes and in other favorable places, he would gradually experiment with other plants and would do something towards forming oases in the desert. Personally I am often in a position to supply seeds for experimental purposes, and if the matter were seriously entered upon, our numerous exchanges with foreign countries would be requested to supply seeds, &c., to further this national work. These depôts would be outposts to reclaim these desert areas, and are as necessary as means of communication. Droughts would recur, and even the depôts would sometimes have a hard fight to exist, but unless it is thought that nothing can be done to re-establish and improve the vegetation on the shifting sands, an opinion that, if held, I do not share, let us *systematically* set to work. I am perfectly certain that if anything can be done in this direction good gardeners can do it, and preliminary work can afterwards be extended to any desired extent. There is no necessity to supply a long list of plants for experimental cultivation, either native or exotic. I will content myself with very few. If I were permitted to carry out my plans, I would attach the gardeners-in-charge of the proposed depôts to the Botanic Gardens for a brief period, in order that they might critically examine all plants likely to be useful for their purposes which are growing in the Garden, and for exchange of ideas, which must be beneficial to all good men. Then I would have experimental plantations made on the coastal sand-dunes near Sydney and study the lessons thus taught.

Mr. McMaster* considers that the cost of plantations is prohibitive, and, admitting that areas are overstocked, is of opinion that the key to the situation is the moving about of stock from one locality to another, so as to prevent the sand-binding plants of any district being eaten out. This can only be done by a system of light railways, and, that being the opinion of a man whose views on this subject command the utmost respect, our people should be educated to advocate them. Mr. McMaster's words are :—

> If these be provided, it is believed that the stock-owners will be able to regulate the quantity of stock their holdings are capable of carrying with safety, and in doing so a condition of affairs will gradually be brought about that will justify the individual as well as the State in giving effect to the valuable proposals by Mr. Maiden; in fact, it may so happen then that nature will assert itself to such an extent that no artificial assistance, other than the railways referred to, will be required to keep the drifting sands in check.
>
> Without railways to relieve the country of stock in times of drought, any attempt to cope with the Sand Problem of the West is regarded as almost hopeless, but with their assistance in the manner indicated, the question will be reduced from one of extreme difficulty to one of comparative simplicity.

8. Plants recommended for Western Sand-dunes.

Just as the Maritime Pine is the principal planted tree of the French Landes and just as I recommend the Norfolk Island Pine for our coastal sand-dunes, so I recommend the Cypress Pine (*Callitris*) as the main standby for the shifting sands of the West. It is a tree of commercial value, and parenthetically I may enjoin discretion in cutting away existing Pine forests out west. My policy would be to raise rows and cross rows of Cypress Pine in sandy country inside the Barrier Range. It is natural there, and Sturt† floundered over successive ridges of deep, loose sand and became entangled in a pine forest near the Barrier Range.

Sugar Gum (*Eucalyptus corynocalyx*). *E. fasciculosa*, F.v.M., and other Western eucalypts (especially Mallees) should be encouraged.

Various Acacias such as Mulga (*A. aneura*), Yarran (*A. homalophylla*), Myall (*A. pendula*), *A. cibaria*, *A. sentis*, and many others should be freely grown. The seeds of Acacias maintain their vitality for a considerable period.

Casuarina.—Belar and Bull Oak. I would also introduce the Desert Oak (*C. Decaisneana*) of Western Australia, the Needlewood (*Hakea leucoptera*), and many other trees and shrubs.

One plant of Porcupine Grass extends in an ever widening circle, the centre becoming dead and hollow. This is a most important natural sand-binder for the sand-hills, and should be conserved. The native grasses in general should be encouraged, as I have already indicated.

Turning to exotic plants, some of the Cowpeas (*Vigna Catjang*) have been recommended as sand-binders. I would also try the Sheep's Burnet (*Poterium sanguisorba*) with its large root stock.

On the Mesas of Arizona and Western Texas is found the "Running Mesquite" (*Bouteloua oligostachya*). This would probably be worth a trial.

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* *Proc. Roy. Soc. N.S.W.*, 1903, p. 141.

† *Narrative of an Expedition, etc.* (1849), I, 223; also II, 34.

The Carob tree is very drought-resistant and might be further experimented with. So also the Pepper Tree (*Schinus molle*), a useful shade tree, though not of use for anything else.

Amongst economic plants the Date Palm takes high rank, and it has for many years been acclimatised in the desert country north of South Australia. I have tasted very fair dates from these palms for several years.

The results of an experimental planting made by the U. S. Division of Forestry in 1890 on the sand-hills of Nebraska seems to have proved that the Banksian Pine (*Pinus divaricata*) is one of the best adapted species for planting in arid conditions.*

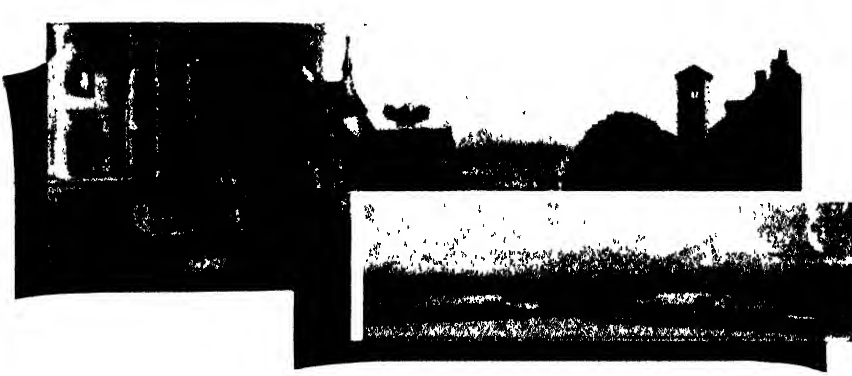
But, as I have already observed, if we could get the depôts I have advocated established or promised, I could get many kinds of seeds for experimental purposes from the arid country in India, North Africa, and the Western United States.

Mr. T. E. Grigg, of Marra Creek, *viâ* Girilambone, has for many years been experimenting on plants under Western conditions, and his short papers are always worth studying, *e.g.*, "Report of experiments carried out at Fareham, Marra Creek" (*Agric. Gaz.*, August, 1906, p. 789), "The deterioration of pastoral country" (July, 1900, p. 610); "A plea for our Western scrub and salt-bushes" (August, 1900, p. 658).

See also R. W. Peacock, "Salt-bushes: their conservation and cultivation" (*Agric. Gaz.*, March, 1904, p 211); "Salt-bushes" (July, 1901, p. 791); "Salt-bushes and edible trees" (February, 1901, p. 225); "Our Western lands: their deterioration and possible improvement" (August, 1900, p. 652); "The reclamation of scalded plains" (July, 1899, p. 635); and many other papers by the same author on Western cultivation problems.

* *Forestry Quarterly*, No. 2, p. 80. See also "Notes on Sand-drift planting in Nebraska," *U. S. Year-book of Agric.* (1895).

(*To be continued.*)



Hawkesbury Agricultural College and Experimental Farm.

THE FEEDING OF PIGS.

[Continued from page 273, 1905.]

H. W. POTTS.

VIII.

THE breeding of the pig to secure such advantages as activity, health, hardiness, early maturity, vigorous digestion, prolificacy, individuality, small bone, light offal, good hams, and a specific development of the most saleable parts of the carcase is the main factor towards payable returns. The German investigator, Märcker, holds that "only animals of the best quality will pay for fattening; feeding inferior beasts on a high diet is simply waste of time and money." This applies with equal significance to the pig as to other farm animals. Another controlling factor of immediate importance is feed. The payable character of the industry depends largely on the wise selection of foods in which their market values have to be closely estimated in comparison with the returns.

Feeding pigs, as with other farm stock, depends upon well-defined general principles. It is necessary to have a knowledge of the composition of foods as determined by chemical analysis, the particular function each ingredient performs, and its digestive power. This is becoming more imperative owing to the large and varied assortment of products now being made available for pork-raising. The desirable aim is to obtain from a given quantity of food the greatest amount of flesh of the best quality, in the shortest time, and at the lowest cost. The analysis of a food is not the sole guide in the selection of a suitable ration.

It may be readily conceded that the pig is the least punctilious of all the domestic animals in choosing its diet. A voracious appetite is an admirable quality in the pig, whose profitable character rests so much on early maturity and quickly fattening propensities, but it must be remembered that whilst it will readily devour all sorts of food, partly decomposed and otherwise damaged, and will practically act as scavengers, yet the edible condition of the flesh and its market value are adversely affected.

In combining foods to provide a balanced ration their composition has to be taken into consideration with the digestibility and appetising character, in order to grow flesh sound in that texture and condition most acceptable to the consumer. The pig's body is found to consist chiefly of water, fat, nitrogenous material, and mineral ash. Water forms from 35 to 60 per cent. of the total weight, according to the age and condition of the animal, while the

fat varies from 6 to 30 per cent. The bony structure, teeth, and some of the body juices are responsible for 2 to 5 per cent. of mineral ash. The flesh, skin, hair, muscles, internal organs, and other parts are principally composed of albuminoids, protein, or other nitrogenous matter.

All foods on which animals subsist contain those substances, and in addition starches, sugars, gums, &c., which are grouped as carbo-hydrates. Water is always found in plants, varying from 6 to 17 per cent. in hay, straw, or grain. to 70 per cent. in ensilage, 80 per cent. in green lucerne, and 90 per cent. in some roots or pumpkins. It assists the digestion and assimilation of foods, and renders them more palatable. Dry matter is the residue after all water or moisture has been expelled by heat. This may be further divided into digestible and inert substances. The former is classified as "digestible nutrient" and goes to form blood, while the other is excreted as urine and manure.

The digestible matter, or portion directly responsible for the process of animal nutrition, is further classified as:—

1. Albuminoids, protein, or nitrogenous substances
2. Carbo-hydrates.
3. Fat.
4. Mineral ash.

Protein, albuminoids, or the parts of food containing nitrogen are the most expensive ingredients of all food-stuffs. They form the gelatinous parts of the bones and tendons, horny matter, and hoofs, ligaments, muscles, red flesh, internal organs, nerves, hair, blood, &c. They supply the daily waste of animal tissue, and to some extent heat and energy, by their conversion in the body into fat

Carbo-hydrates.—The non-nitrogenous parts of food and the body are divided into two classes—carbo-hydrates and fat. The former are the primary sources of heat and energy in the animal, and are associated with foods as starches, sugars, gums, fibres, &c. They are converted into fats, and used as fuel, also for storing fat in the animal tissues. They form the bulkiest parts of all foods. Pigs possess the facility or digestive function in "markedly high degree for converting carbo-hydrates into fat in distinct contrast with other animals."

Fats and oils in foods are also energy and heat producers, and influence the firmness, appearance, and composition of fatty flesh in the pig. In several respects fats act similarly to carbo-hydrates. In the constitution of fat it is approximately estimated that it provides two and a fourth times as much heat as the carbo-hydrates.

Mineral ash is largely composed of lime and phosphoric acid, with smaller quantities of potash, magnesia, soda, chlorine, sulphuric and carbonic acids, with traces of silica. This in foods aids in building up the bony structure, the growth of teeth, and essential elements in the blood and body juices.

In the selection of foods we must be conversant with the percentage of digestible nutrients. Feeding standards on a scientific basis have been

established, and from these we are enabled to formulate rations most likely to afford a high-quality flesh rapidly, and at the least expense. The constituents of the foods require to be arranged or balanced in order that the protein may bear a certain proportion to the carbo-hydrates and fat to meet the requirements of a maximum growth. This is termed the nutritive or albuminoid ratio. The market values of the foods naturally demand the closest scrutiny in their selection. In fattening pigs three periods of progress are recognised. The first period covers about six months, during which the animal assimilates food more profitably than during the later periods, or in other words, pigs store flesh at a less cost per pound for feed during the first six months of their existence. This influences the market requirements in favour of young stock for slaughter.

To ascertain the albuminoid ratio in any food or combination, the fat percentage is first multiplied by two and a fourth, the product is added to the percentage of carbo-hydrates, and the sum divided by the percentage of albuminoids. The quotient is the nutritive ratio, or the proportion between the protein, or nitrogenous food constituents, and the carbo-hydrates and fat, or non-nitrogenous ingredients. It is thus seen that the balanced ration is a useful guide from an economical standpoint. All farm foods contain protein, carbo-hydrates, fats, mineral ash, and water in varying quantities, and the object is to arrange these in order that the animal economy may be secured in its different purposes, that is, to daily replace waste tissue, to maintain body heat and muscular energy, to store fat and lean flesh, to reproduce young, and to provide for their early nourishment. It is most essential to keep the young animal thrifty and constantly growing from birth.

The nutritive ratio is sometimes termed "narrow," "wide," or "medium" and this is determined by the quantity of protein. A "narrow" ration should contain a high percentage of protein, not less than 1 : 5·5; between 1 : 5·5 and 1 : 8 is known as "medium"; and any proportion over 1 : 8 is termed "wide."

The following table affords information relating to the needs of pigs:—

FEEDING STANDARDS (Wolff) for growing Pigs (fattening) per head per day.

Age.	Weight.	Total Dry Matter.	Digestible Nutrients.		
			Albumenoids or Protein	Carbo-hydrates and Fat.	Nutritive Ratio.
	lb.	lb.	lb.	lb.	lb.
2 to 3 months	50	2·1	0·38	1·50	1 : 4
3 to 5 ,,	100	3·4	0·50	2·50	1 : 5
5 to 6 ,,	124	3·9	0·54	2·96	1 : 5·5
6 to 8 ,,	170	4·6	0·58	3·47	1 : 6
8 to 12 ,,	250	5·2	0·62	4·05	1 . 6·5

Brood sows weighing 200 lb. require 4·4 lb. dry matter daily, and a broader ration of 1 to 6·6; and yelts when maturing and intended for breeding purposes require less food per day and a nutritive ratio of about 1 to 7·5.

Pastures for Pigs.

All the natural conditions for the propagation of animal life in its highest form exist in Australia. Our dry, pure, rarified air, genial and constant sunlight, and scanty rainfall, all combine to provide a healthy, flourishing, tender form of pasturage, and maintain an environment eminently favourable to animal growth.

The open pasturage system, or paddocking of pigs, is profitable when economically linked with feeding on maize, potatoes, cereals, other available starchy foods, or the by-products of the dairy. Ample shelter, shade, and a good water supply are useful adjuncts. All young pigs do best on pasturage,

Paspalum dilatatum.
Three months after planting. Fit to be cut for the pigs

provided they are permitted to become accustomed to it from birth. A young animal thrives better and develops frame and muscular energy to lay the foundation of a carcase, but can be readily fattened in the sty at a later stage.

Small paddocks have their drawbacks in several directions, xcepting where special fodders or grasses are especially grown and cultivated.

Pigs fed on grass in combination with other foods invariably provide a class of bacon or pork with a distinctively palatable flavour and firm texture. Possibly the most serviceable of all grasses in our climate is the couch, otherwise known as Doub, Scutch grass, Dog's tooth, Wiry grass, or Bermuda

grass (*Cynodon dactylon*). Under favourable conditions it provides all the elements for maintaining a healthy growth, and is highly relished by pigs of all breeds and ages. It grows most vigorously in summer, and on the sea-board areas is a useful summer grass. It remains green and succulent longer under high temperatures than most of our natural grasses. Where sufficient moisture prevails it will thrive on the poorest of sandy loams—in fact it often spreads over pure sand. Wherever there is shade and it is deprived of sunlight it fades away. It is a compact and dense turf or sod-former, and will run over any other grass excepting Paspalum or Rhodes grass. The creeping or stoloniferous stems run underground, and are fleshy, sweet, and nutritious, and afford good food for pigs. They cannot eat it

Rhodes Grass.

In a condition fit for grazing pigs; usually known as *Chloris virgata*, but now identified by Mr J. H Maiden, Government Botanist, as *Chloris Gayana*, var

out, seeing it is perennial in habit and sturdy. It will always appear rapidly after severe heat or frost. The root system of the grass lends itself admirably to pig-feeding.

In fairly good seasons five to eight pigs may be grazed to the acre. The open-air life, the regular exercise entailed in the search for food, and the sweetness of the pasturage all combine to improve the character of the flesh, and induce a healthy vigorous growth.

After weaning their litters and being served sows secure the best health conditions by openly grazing in sound paddocks until within a fortnight of farrowing again. It may be necessary to supplement this with other foods to keep them in normal condition.

Another grass of similar root habit has lately come under notice—Rhodes grass, *Chloris Gayana* var. The creeping stems are thicker and are inclined to become harsh and fibrous. In the young stage of growth it is, however, very succulent, and according to the analysis recently issued by M. Brünnich, Queensland, it is more nutritious. The nutritive ratio is 1 : 8·4. This grass spreads with extraordinary rapidity. Our experiences points to the need for keeping it well stocked to check the growth of harsh stems and a coarse flag.

Amongst grasses of tussocky growth we may place *Paspalum dilatatum* in the front rank. It has a nutritive ratio of 1 : 10·8. In good seasons on rich soil, especially in the coastal districts, this grass grows large yields of palatable fodder.

It would be an advantage to sow the seed with equal quantities of lucerne or clover, preferably the former, owing to its high albumenoid contents. The combination would provide a much better balanced ration, especially for young pigs.

Rye grass, Cock's-foot, Prairie, all belong to the tussock form of grasses, and are highly nourishing. In laying down pastures of these grasses the addition of lucerne or clover will in each instance enhance their food value for pork raising. During the prevalence of drought the most reliable of all the grasses is the Hare grass, *Erogrostis pilosa.*

Monthly Weather Report.

HAWKESBURY AGRICULTURAL COLLEGE.

Summary for September, 1906.

Air Pressure (Barometer.)			Shade Temperature.				Air Moisture Saturation=100.			Evaporation (from Water Surface).			
Lowest.	Highest.	Mean.	Lowest.	Highest.	Mean.	Mean for 14 years.	Lowest.	Highest.	Mean.	Most in a Day.	Total for Month.	Monthly Mean for 8 years.	% of year's Evaporation.
29·71 18th.	30·38 29th.	30·09	35·7 7th.	79·3 27th.	56·91	57·339	49 19th.	100 10th.	73·96	·215 19th.	3·086	3·262	6·7

Rainfall														
	Dates	1	3	4	5	6	10	11	13	15	22	23	24	30
	Points	1	7	2	1	1	2	6	4	29½	32	4	2¼	3 = 95 points.

Mean for 14 years, 190 points.

	N	NE	E	SE	S	NW
Wind	8	10	4	1	5	2

Thunderstorms on 2nd, 22nd.

Greatest daily range of temperature, 35·8° on 8th.

Days on which temperature fell below 42°—	7	8	14	16	17	20
	35·7°	40·6°	41·5°	36·4°	38°	36°

W. MERVYN CARNE,
Observer.

MANURE EXPERIMENTS WITH MANGOLDS.

Experiments with Fertilisers

GEORGE MARKS,
Instructor in Agriculture, Hawkesbury Agricultural College.

A SERIES of experiments with various chemical fertilisers was carried out during the past season, the crops chosen for these trials being mangold, sorghum, and maize. The weather conditions were not favourable for good results, the low rainfall preventing the plants from obtaining sufficient moisture for their requirements. The chemical fertilisers were supplied by Mr. Hattrick, of the Australian offices of the Potash Syndicate.

Mangolds.

The experiment with this crop was carried out on the rich alluvial soil of the River Farm. The land selected for this purpose had been cropped previously with barley, which had been grazed off by stock. In early spring the soil was ploughed to a depth of 10 inches, and brought to a state of fine tilth. Drills were opened with a ridging plough 2 ft. 6 in. apart, and the farm-yard manure and chemical fertilisers were evenly distributed along these. The farm-yard manure used was well-rotted horse manure. By running the ridging plough between the drills opened out, the soil was ridged up over the manures. This was done so as to increase the depth of soil for the roots to develop in. Mammoth Long Red was the variety chosen for the experiment. The seed prior to sowing was steeped in warm water for six hours, the object being to soften the hard outer covering of the seed and promote speedy germination. It was then allowed to drain and dry in the sun, and afterwards sown along the tops of the drills with a Planet Jr. hand seed drill at the rate of 5lb. to the acre. Sowing took place on the 26th September, 1905. The soil was beautifully moist at the time of sowing, and a good stand was made by the young plants. The object of this experiment was to find out the effect of the various manures on this soil, which, to the average individual, appeared to be rich enough. The rainfall during the period of growth was very irregular, and the excessive dry heat during the summer months had the effect of giving the plants a severe check, from which they did not recover completely. Fifteen inches of rain fell during the time the crop occupied the ground. Ten plots were planted, each one-twentieth of an acre in extent. The ground was kept free of weeds by the constant use of the hand hoes, while the plants were small, and the Planet Jr. cultivator. Harvesting took place in April. The roots were pulled up by hand, and allowed to dry for five or six hours in the sun, and the following day weighed. Although there is a big difference in the yields of the two unmanured plots, the average of these two shows a much lower return than

any of the others, and the results indicate that this seemingly rich soil will readily respond with increased returns by the judicious application of suitable fertilisers. In addition to the chemical manures, farm-yard manure was also used, but only the cost of the former is shown in the table. The farm-yard manure cost only the carting and spreading of it, which would amount to the same on most farms. The following table shows the kinds and amounts of manures used, the yields of the plots, and the rate per acre. The mangolds were utilised for feeding pigs.

No. of Plot	Manures used	Amount per Plot	Amount per Acre	Cost per Acre.	Yield of Plot.	Yield per Acre.
				s. d.	cwt. qr. lb.	tons cwt. qr. lb.
1	*Unmanured				2 3 19	2 15 3 16
2	Farm-yard manure	10 cwt.	10 tons.			
	Superphosphate	11 lb.	2 cwt.	9 0	17 1 17	17 8 0 4
3	Farm-yard manure	10 cwt.	10 tons.			
	Kainit	22 lb.	4 cwt.	15 0	16 1 22	16 8 3 20
4	Farm-yard manure	10 cwt.	10 tons.			
	Nitrate of soda	5½ lb.	1 cwt.	10 0	14 0 0	14 0 0 0
5	Farm-yard manure	10 cwt.	10 tons.			
	Superphosphate	11 lb.	2 cwt.	24 0	14 1 7	14 6 1 0
	Kainit	22 ,,	4 ,,			
6	Farm-yard manure	10 cwt.	10 tons.			
	Superphosphate	11 lb.	2 cwt.	19 0	13 3 16	13 17 3 12
	Nitrate of soda	5½ ,,	1 ,,			
7	Farm-yard manure	10 cwt.	10 tons			
	Kainit	22 lb.	4 cwt.	25 0	15 1 4	15 5 2 24
	Nitrate of soda	5½ ,,	1 ,,			
8	Farm-yard manure	10 cwt.	10 tons			
	Kainit	22 lb.	4 cwt.			
	Nitrate of soda	5½ ,,	1 ,,	34 0	17 0 23	17 4 0 3
	Superphosphate	11 ,,	2 ,,			
9	Farm-yard manure	10 cwt.	10 tons.			
	Superphosphate	11 lb.	2 cwt.			
	Kainit	11 ,,	2 ,,	26 6	12 3 19	12 18 1 16
	Nitrate of soda	5½ ,,	1 ,,			
10	*Unmanured	...	...	...	6 3 0	6 15 0 0

* Average yield of Plots 1 and 10, 4 tons 16 cwt. 2 qr. 22 lb per acre.

Sorghum.

This fertiliser experiment was carried out on the experimental plots at the College. The soil was a poor pipe-clay loam. It received two ploughings prior to planting, the last taking place in early spring, and the soil brought to a state of fine tilth in September. Drills were opened up with a plough, 3 feet apart and about 4 inches deep, and the chemical fertilisers evenly distributed along them. Early Amber Cane was chosen for the trial. The

seed was sown with a Farmers' Friend seed-drill at the rate of 6 lb. to the acre, on the 11th October, 1905. The drills were then lightly covered in with the harrow. The weather conditions were not favourable for good growth, and the continued dry weather during the summer months completely stunted the crop. The rainfall covering the season of growth was as follows:—

1905.		1906.	
October	.09	January	2.31
November ...	1.81	February ...	.71
December ...	4.74	March	3.30
		April	.15
	Total	13.11	

The Amber Cane was harvested in April after it had flowered, and when it appeared to have made its maximum amount of green growth. It was cut with sickles by hand, close to the ground, and weighed while green. As a result of the unfavourable season only one crop was obtained, the early frosts cutting the second growth while about 18 inches high. The following table gives the kinds, amounts, and cost of manures per acre, and the yields obtained. Each plot was one-twentieth of an acre in size.

No. of Plot	Manure used	Amount per Plot	Amount per Acre	Cost per Acre		Yield of Plot			Yield per Acre.			
		lb.	lb.	s.	d.	cwt.	qr.	lb.	tons	cwt.	qr.	lb.
1	*No manure					9	1	0	9	5	0	0
2	Superphosphate	6⅖	128	4	10	16	1	7	16	6	1	0
3	Muriate of potash	3⅕	64	7	8	17	3	0	17	15	0	0
4	Sulphate of ammonia	1⅗	32	3	10	15	2	0	15	10	0	0
5	Superphosphate Muriate of potash	6⅖ 3⅕	128 64	12	6	14	2	2	14	10	1	12
6	Superphosphate Sulphate of ammonia	6⅖ 1⅗	128 32	8	8	16	1	0	16	5	0	0
7	Muriate of potash Sulphate of ammonia	3⅕ 1⅗	64 32	11	6	10	3	0	10	15	0	0
8	Superphosphate Muriate of potash Sulphate of ammonia	6⅖ 3⅕ 1⅗	128 64 32	16	4	16	2	0	16	10	0	0
9	Superphosphate Sulphate of potash Sulphate of ammonia ..	6⅖ 3⅕ 1⅗	128 64 32	16	4	16	0	0	16	0	0	0
10	*No manure					15	2	0	15	10	0	0

* Average of Nos. 1 and 10—Per plot, 12 cwt. 1 qr. 14 lb.; per acre, 12 tons 7 cwt. 2 qr.

Maize.

Fertiliser experiments with maize were carried out on the experimental plots at the College, and on the rich alluvial soil of the River Farm.

Experimental Plots.

Plot B6 was selected for this trial. It consists of a light, poor pipe-clay loam. Turnips and Swedes had been grown in it previously. It received two ploughings, one in the winter and the other in early spring, the soil being ploughed to a depth of 10 inches, and worked down to a fine state of tilth. Drills were struck out about 4 inches deep, 4 ft. 6 in. apart, and the manure distributed along these evenly by hand. The variety chosen for the trial was Pride of the North. The seed was sown by the Farmers' Friend seed-drill at the rate of 6 lb. to the acre, on the 10th October, 1905; and a light lever harrow run over the drills to cover the manures. The seed germinated well, and as the plants grew the drills were gradually filled in by the harrows and cultivators. The soil between the rows was kept loose and free from weeds by regular working with the cultivator. The crop was grown on the flat system, so as to prevent as far as possible excessive evaporation of soil moisture. Each plot consisted of one-twentieth of an acre. Hot dry weather set in just as the crop was tasselling, and resulted in somewhat light yields. The rainfall during the season of growth was 14 inches. Harvesting took place in April. The following table shows the kinds and amounts of fertilisers used, with their cost per acre, the yield of each plot, and the estimated yield per acre:—

FERTILISER Experiment with Maize on Experimental Plots.

No. of Plot.	Kinds of Manure.	Amount per Plot.	Amount per Acre.	Cost per Acre.	Yield of Plot, shelled Grain.	Yield per Acre, shelled Grain.
		lb.	lb.	s. d.	bush. lb.	bush. lb.
1	*Unmanured ...	...	...		1 27	29 36
2	Superphosphate	6 2/5	128	4 10	1 29	30 20
3	Muriate of potash	3 1/5	64	7 8	1 18	26 24
4	Sulphate of ammonia	1 3/5	32	3 10	1 42	35 0
5	Superphosphate Muriate of potash	6 2/5 3 1/5	128 64	12 6	2 5	41 44
6	Superphosphate Sulphate of ammonia	6 2/5 1 3/5	128 32	8 8	2 13	44 36
7	Muriate of potash Sulphate of ammonia	3 1/5 1 3/5	64 32	11 6	1 20	27 8
8	Superphosphate Muriate of potash Sulphate of ammonia	6 2/5 3 1/5 1 3/5	128 64 32	16 4	1 33	31 44
9	Superphosphate Sulphate of potash Sulphate of ammonia	6 2/5 3 1/5 1 3/5	128 64 32	16 4	1 32	31 24
10	*Unmanured ...	....	...	...	0 54	19 16

* Average yield of Plots 1 and 10, 24 bush. 26 lb. per acre.

River Farm.

A site for this experiment was selected on the river bank, where the soil was rich, deep, and friable. It was ploughed twice before sowing took place. The trial was a duplicate of that carried out on the experimental plots. Sowing took place on the 3rd October, and the crop was harvested in April. A number of the plants were destroyed by cut-worms shortly after sprouting, which necessitated a second sowing to fill the misses. The rainfall and weather conditions generally were, practically speaking, identical with those experienced on the experimental plots. The following table gives the yields:—

FERTILISER Experiment with Maize on River Farm.

No. of Plot.	Kinds of Manure.	Amount per Plot.	Amount per Acre	Cost per Acre.		Yield of Plot, shelled Grain.		Yield per Acre, shelled Grain.	
		lb.	lb.	s.	d.	bush.	lb.	bush.	lb.
1	*Unmanured	...				1	38	33	32
2	Superphosphate	$6\frac{2}{5}$	128	4	10	2	3	41	4
3	Muriate of potash	$3\frac{1}{5}$	64	7	8	1	33	31	44
4	Sulphate of ammonia	$1\frac{3}{5}$	32	3	10	1	23	28	12
5	Superphosphate Muriate of potash	$6\frac{2}{5}$ $3\frac{1}{5}$	128 64	12	6	2	14	45	0
6	Superphosphate Sulphate of ammonia	$6\frac{2}{5}$ $1\frac{3}{5}$	128 32	8	8	3	0	60	0
7	Muriate of potash Sulphate of ammonia	$3\frac{1}{5}$ $1\frac{3}{5}$	64 32	11	6	3	28	70	0
8	Superphosphate Muriate of potash Sulphate of ammonia	$6\frac{2}{5}$ $3\frac{1}{5}$ $1\frac{3}{5}$	128 64 32	16	4	3	11	63	52
9	Superphosphate Sulphate of potash Sulphate of ammonia	$6\frac{2}{5}$ $3\frac{1}{5}$ $1\frac{3}{5}$	128 64 32	16	4	3	27	69	36
10	*Unmanured	...	...	...		3	1	60	20

* Average yield of Plots 1 and 10, 46 bush. 54 lb. per acre.

Variety Trial of Maize for Grain, River Farm.

Thirty-one varieties of maize were planted on the River Farm with the view of comparing their grain-yielding capacities. The land was deep, rich, and friable, and was well prepared by ploughing, harrowing, &c., for sowing. The seed of the various varieties was sown immediately after the manure experiment was planted. No artificial fertiliser was used. Each plot consisted of one-fortieth of an acre. There being so many distinct types grown side by side, it was impossible to prevent all of the varieties from crossing, and though pure seed of the individual varieties could not be relied on in harvesting, it would not interfere with the experiment, as far as the yields were concerned. Harvesting took place in late autumn. The cobs of each were shelled by hand, and both the shelled seed and cores were weighed separately. It will be noticed in the table that the yields of grain and core are given separately, and also their respective yields per acre. The Golden King while giving the largest yield of grain, gave by far the largest percentage of core; while such varieties as Early Leaming, Red Hogan, and Abercrombie gave very fair yields, but a much smaller percentage of core.

VARIETY Trial of Maize for Grain grown on River Farm.

Variety.	Per Plot. Grain.	Per Plot. Cores.	Per Acre. Grain		Per Acre. Cores	Variety.	Per Plot. Grain.	Per Plot. Cores.	Per Acre. Grain		Per Acre. Cores
	lb	lb	bus	lb	lb		lb	lb	bus	lb	lb
Golden King	97	25	79	16	1,000	Golden Drop ..	63	13	45	0	520
Early Leaming .	96	14	68	32	560	Riley's Favorite.	62	11	44	16	440
Gosper's Peg Tooth	95	16	67	48	640	Golden Beauty	55	12	39	16	480
Improved Gold Mine.	87	17	62	8	680	Iowa Silver Mine	53	11	37	48	440
Clarence Wonder..	86	17	61	24	680	Large Selected White.	52	9	37	8	360
Red Hogan	86	14	61	24	560	Hickory King	49	8	35	0	320
Golden Dent .	83	15	59	16	600	Iowa Gold Mine..	47	8	33	32	320
King's Early	76	12	54	16	480	Longfellow Dent	42	9	30	0	360
Yellow Hogan	74	13	52	48	520	White Horse-Tooth.	39	15	27	48	600
Selected Horse-Tooth.	73	13	52	8	520	Cinquatina . .	31	4	22	8	160
Large Yellow Horse-Tooth.	71	17	50	40	680	Extra Early Zkeley.	13	3	9	16	120
Abercrombie	68	8	48	32	320	Sixty-Day .	5	2	3	32	80
Hawkesbury Champion.	68	18	48	32	720	Black Mexican ...	5	2	3	32	80
Ninety-Day ..	67	16	47	48	640	Red Pop .	4	1	2	48	40
Yellow Flint ..	67	15	47	48	600	White Pop .	4	3	2	48	120
Yellow Horse-Tooth.	63	16	45	0	640						

Caterpillars in the Tamworth District.

At the request of Mr. G. A. Codrington, proprietor of *The Tamworth News*, Mr. W. W. Froggatt, Government Entomologist, visited Tamworth to investigate the damage done by caterpillars in the district, and suggest some means of coping with the pest.

Mr. Froggatt visited several farms, where numbers of the insects were seen on the lucerne and grass. Mr. C. J. Britten had tried using chain harrows at his farm with very good effect; the harder the ground the better was the result. Mr. Froggatt observed the habits of the caterpillar, and found that it was most active during the warm part of the day, from 10 a.m. to 4 p.m., and it is during this time that the harrows did the most effective work, for while the caterpillars were hiding in the soil the harrows could not reach them.

Experiments were made with poisoned pollard in a grass paddock, with very satisfactory results, the poison being scattered broadcast so that stock could not pick it up. The result of this experiment was most satisfactory; the caterpillars eat it readily. It was also noticed that the dead caterpillars were being devoured by the live ones.

The poison baits were made by mixing 1 oz. of Paris green with 1 lb. of pollard or bran together with a little sugar or treacle and sufficient water to make a dry dough.

It was apparent that by this means the bulk of the caterpillars could be killed at a low cost. Many crops could be saved by this means, while if the caterpillars were allowed to go unchecked, they would devastate a whole area.

The caterpillars that have swarmed out this season are not the larvæ of the climbing cut-worm or American army worm (*Leucania unipuncta*), but the larvæ of the Bugong moth (*Agrotis infusa*), which is now a grass and lucerne pest.

Since this visit Mr. Britten has sent down specimens of another cut-worm found in his barley paddocks which are undoubtedly the larvæ of the Army cut-worm moth (*Leucania unipuncta*), (see *Agricultural Gazette*, April, 1904, page 327,) which is such a serious pest to wheat, barley, and oat crops. Mr. Britten informs Mr. Froggatt that though numerous in some of his paddocks he has been busy distributing poisoned bran over the infested areas, and thinks he can keep them under in this manner. As soon as the fields come into ear all farmers should keep a watchful eye on these pests.

Squaring a Gate-post.

J. WM. CHAPMAN,
Cowra Experimental Farm.

For a gate-post, a bushman likes to have a perfectly sound log. He is not always able to secure this, and often has to be content with one containing a small hollow or " pipe "; he then reflects that such is not really detrimental, and that after all, it can be plugged up when the squaring is completed.

A log with a straight free-running grain is the more easily worked, but one with a curly grain is the more durable.

A suitable tree having been chosen and felled, and the necessary log having been cut off, the first operation consists in removing the bark; the sooner, after falling, this and the subsequent operations are done, the easier they will be.

The tools necessary for squaring a log are, an American axe, a squaring or broad axe, a level with a plumbing bulb, a rule or measure, a pencil, a line or string, and some chalk or other material for coating the string so that it will make a mark on the log.

Fig. 1.—The log barked ready for squaring.

For the sake of stability, as large a butt as is possible is left on the gate-post; only that portion, therefore, which is to stand above the ground is squared. The length of this portion is measured off, and the log fixed so that it will remain steady while the ends are being marked, at the same time it is placed in such a position that the most may be made of the timber it contains. The ease and readiness with which this is done depends entirely upon the skill and judgment—largely the result of practice and experience—of the axeman.

The squares or rectangles are now marked on the ends with the aid of the level and rule. The first line (a vertical one) is obtained by drawing a pencil along the face of the level when it is held " plumb " and as close to the edge as it is deemed advisable to go. The line at right angles to this is obtained by drawing a line along the top of the same instrument when it is held level. The other lines, necessary to complete the rectangle, are then obtained without difficulty by measurements. Another way of marking the first line on both ends, is with the aid of a plumb-line. The other lines are then marked off it with the aid of a blacksmith's or other square and a measure.

It is very necessary that some method be adopted to prevent a " wind " or twist in the squared log. Marking the first line on each end with the plumb-line or level, is an easy and satisfactory way of preventing this ; but, in the

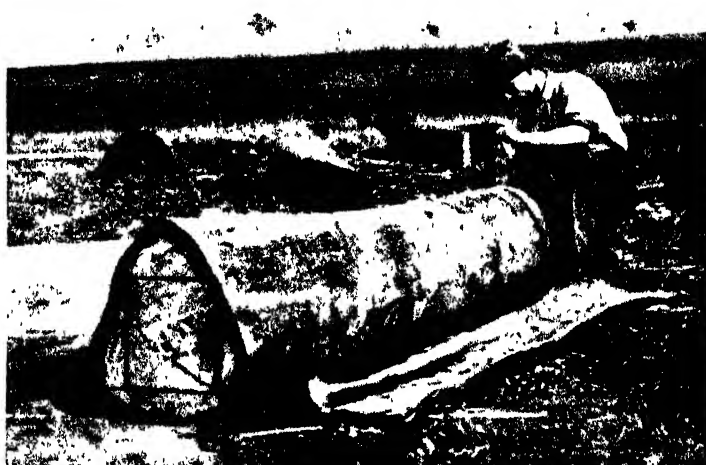


Fig. 2.—Marking the ends.

absence of either a plumb-line or a level, the " wind " may be prevented by marking the first line on each end with the aid of two laths, or light battens, used in the following manner. A lath, or batten, is tacked to one end of the log in either a vertical, or a horizontal position, the other lath is then held on the opposite end of the log, so that the edges of both laths " line," or correspond with each other, when sighted across. The longer the laths the more accurate is the work likely to be.

The ends having been marked, it is necessary to connect these marks with lines which will show the axeman how deep to chop. These lines are marked or " struck " in a similar manner to that adopted by a carpenter for marking a chalk line on a board. A carpenter's line, a piece of fishing-line, or failing these, a piece of string or sewing-twine is used. Instead of coating the string with dry chalk as the carpenter does, it is found better, for the work in hand,

to use a black or a white liquid. Black is to be preferred as it makes a better mark than white on the green log. A suitable liquid is made by mixing charcoal, soot, or burnt straw, with water. To make a white mark, lime-wash or whitening and water is used.

Fig. 3.—Winding the line for "striking" the sides.

A knot is tied in one end of the string, which is then wound crossways on the thumb and little finger of the left hand; it is then placed in the black or white mixture until saturated, when it is taken out, the knotted end is taken hold of, and the wound-up portion thrown out with a smart jerk; it should fall out quite clear and free from tangles. The knotted end is now placed in an axe-nick previously made on the end of the log and in a line with one of the vertical marks on one end of the log; the other end of the line is taken and held at the point where a continuation of the corresponding vertical line on the other end would meet the the uppermost surface of the log With one hand the line is pulled tight and held firmly at this place, whilst it is

Fig. 4.—"Striking."

seized towards the middle with the other hand and stretched upwards, held for an instant, and then released. It strikes the log with a smart smack and leaves a straight but somewhat bespattered mark connecting the uppermost ends of the two vertical lines on opposite ends of the log. Another line is

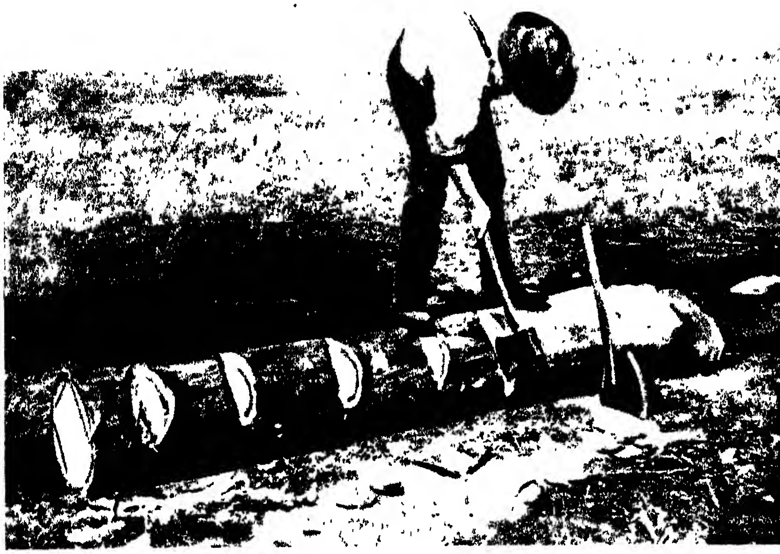


Fig. 5. - Chopping to the line

Fig. 6.- Splitting to the line.

Fig. 7.—Squaring the edges.

Fig. 8.—Striking after the first two edges have been squared.

now "struck" on the other edge of the log. The log is then rolled over and corresponding lines struck on both edges of the other side of the log.

Cuts, or kerfs, at intervals of 9 to 12 inches, are now chopped with a common axe, almost to the lines "struck." The intervening blocks are then split off with the same axe, after which, the edges are finally trimmed with the squaring axe.

Fig. 9.—Finished.

The partially-squared log is now rolled over until the remaining marks on the ends are in a vertical position; lines connecting these marks are "struck" and the edges squared as the others were squared. The top is then rounded off with axe and adze. This completes the squaring, the post is finished, and is ready for setting in the ground.

School Agriculture

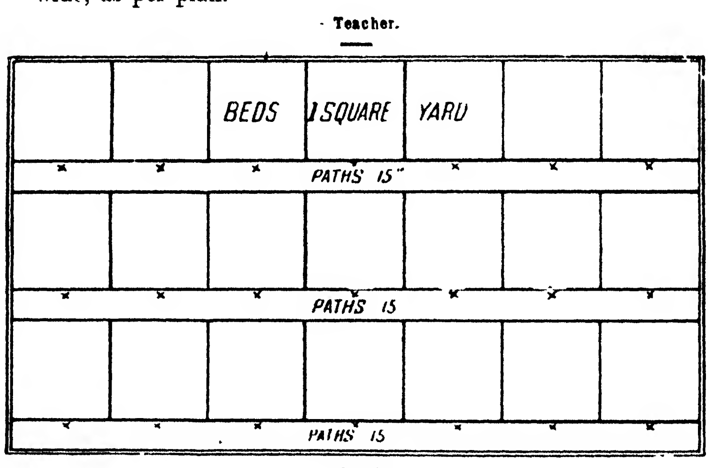
[Continued from page 910.]

Eglinton Public School Method.

II.

The most important period of a child's tuition is during its infancy. First impressions are always the best. It is not the area under cultivation which will cause the most lasting impression, but the system adopted, the methods employed, and the seasons for cultivation. Hence the infant classes must receive the most careful handling and thorough tuition. To meet such demands the following considerations should be followed:—

1. Select a level piece of ground.
2. Thoroughly dig and level the whole area.
3. Measure the land off in beds a yard in width with paths 15 inches wide, as per plan.



4. Enclose each bed with 3 in. x 1 in. hardwood battens, made smooth on the upper edge.
5. Divide the plots into square yards, separating each bed with a piece of batten a yard long.
6. The edge of the batten adjacent to the child should be marked off in feet and inches with saw cuts.
7. All pupils should be taught to find the length of the span of the right-hand between the thumb and first finger, and the thumb and little finger.
8. Each bed should be numbered on the batten nearest the teacher.

9. Each bed should be allotted to the most deserving pupil, and the privilege of having a bed made an incentive to good conduct.
10. The teacher should face the class, and each pupil face the teacher.
11. The plants should be neatly arranged, large ones in the centre and the smaller ones radiating to the outer edge.
12. Let all the instructions in planting, sowing, use of gardening tools, &c., be simultaneously given.

It is highly necessary that accurate records should be kept by all elder pupils of any work undertaken in the garden. The following method should be adopted. It is naturally concluded that each bed has been carefully measured and contains the fractional part of an acre. By so doing it is only a matter of multiplication to ascertain what results would be obtained per acre under similar conditions.

Small note books should be procured by each pupil, in which on the first page should be recorded the area of the plot, what fraction of an acre it is, and the date of possession, name of pupil, and age of pupil; on the second page, down the margin in small writing, should be the following headings:—

1. Period of digging.
2. When manured.
3. Variety of manure.
4. Amount of manure.
5. Period of sowing.
6. Period of planting.
7. Quantity of seed sown.
8. Number of plants used.
9. Appearance of growth.
10. When harvested.
11. Variations of season.
12. Atmospheric conditions.
13. Amount of rainfall.
14. Period of rainfall.
15. Application of water.
16. Any particular methods employed.
17. Altitude.

The remaining leaves of the book should be cut away to fit these headings. One page should be devoted to each bed. Once writing the above heading serves for the whole book. At the back of the book should be attached a calendar of the vegetable and flower growths for each season.

The apparatus used to illustrate the physical properties of soil were:—

For strata—

a. Obtain cylindrical lamp glasses.

b The top to be used as the bottom to obtain equality.

c Make a stand for glasses, as per diagram.
d Securely fix into the tubes pieces of cork, and coat them with wax.
e Collect different soils and thoroughly dry them.
f Carefully weigh, and keep a record.
g Add water and shake together at intervals for two days.
h Allow them to settle and note strata.

For percolation—
a Obtain cylindrical lamp glasses and stand, as in previous experiment.
b Attach around the shoulder 2 or 3 inches of stiff cardboard to lift them off the base of the stand.
c Fill in an inch of cotton-wool at the lower end.
d Securely attach around the outside of the tube at the bottom a piece of calico.
e Add water, and carefully watch for it to percolate.

For capillarity—
a Procure a set of capillary tubes of various sizes, and a wide tumbler. (Fig. A.)
b Half fill the tumbler with coloured water.
c Take a piece of cardboard larger than the top of the glass, and make some holes in it at equal distances to hold the capillary tubes.
d Place the tubes through the holes and allow the ends of the tubes to extend into the coloured water.
e Note which rises the highest.

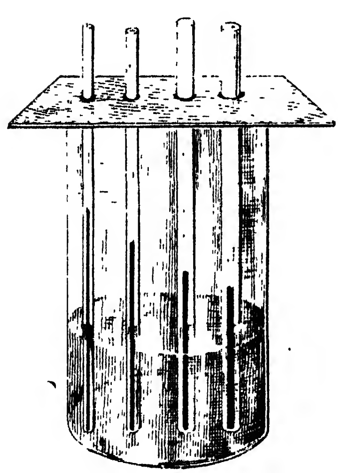


Fig. A.

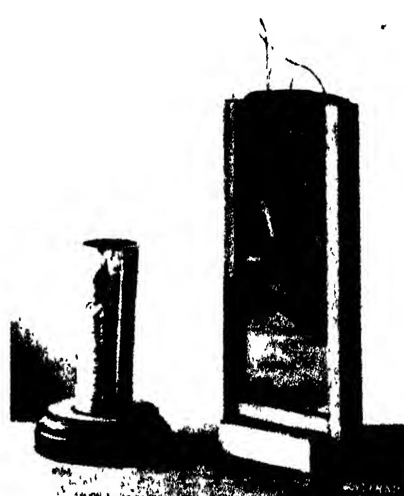
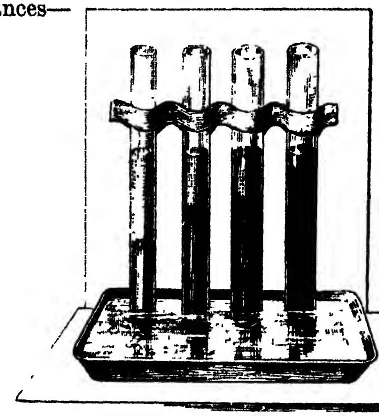


Fig. B.

Seed growth—
a Procure incandescent lamp-glasses, fit them into a stand of wood, line them with blotting-paper, and fill with sand. (Fig. B)
b Between glass and blotting-paper place the seed.
c Keep the sand moist and watch developments.
Wider glasses can be obtained when seed in different positions can be experimented with. All developments should be carefully noted as to growth, radicle, plumule, &c.



Attraction between solid and liquid substances—

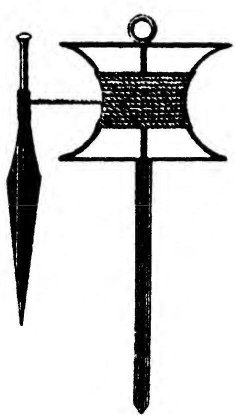
a Procure three or four glass tubes, cylindrical lamp-glasses will suit.
b At the base fit in firmly about an inch or an inch and a half of cotton wool.
c Nearly fill them with fine pulverised earth of various natures.
d Procure a tin pan about 2 inches deep, cover the bottom with gravel, and fill with water.
e Place the ends of the tubes in the dish of water and watch the rise of the water, noting the time of starting and ending.
f The tubes should be secured to a piece of board and carefully strapped.

Dibbers or diblers—

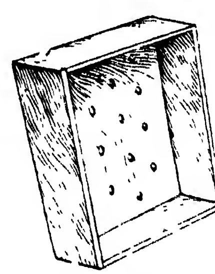
These are necessary for planting potatoes, broad beans, &c., and transplanting seedlings. Too often an ordinary piece of stick is used, and the hole is too small; this causes the roots to become inverted, or seeds to be too deeply and unevenly planted.

a Procure an old spade-handle.
b Cut off the length required, about 15 inches.
c Work the end into a rather thick point.
d Mark off from the end 3, 6, and 9 inches, at which points bore a hole.
e Obtain a peg or iron bolt to fit the holes protruding on each side about 3 or 4 inches. This will equalise the depth of planting.

Dibber.



Line and Reel.



Seed-box.

Line and reel—

This is an absolute necessity for laying out the grounds, and making planting uniform.

Seed boxes—

All flower, and many fine garden seeds require to be raised in boxes and transplanted. The boxes should be 4 to 6 inches deep, and liberally supplied with holes at the bottom for drainage. The bottom should be lined with small pieces of charcoal, then a layer of dry leaves, and the remainder filled with prepared soil to within half an inch of the top.

Chemical Notes.

THE USE OF LIME IN AGRICULTURE.

F. B. GUTHRIE.

BY "liming" is understood the application to the soil of lime in the form of burnt lime, either powdered or freshly slaked. In some cases the application of chalk or of so-called "mild" or "agricultural" lime, which are all forms of carbonate of lime, is beneficial, but their action is somewhat different in character to that of burnt lime.

There are few soils which will not derive benefit from the application of lime, even when this substance is present in fair proportion in the soil. A. D. Hall, Director of the Rothamsted Station, states that English experience shows that soils containing less than 1 per cent. carbonate of lime require liming. This represents about ½ per cent. lime, and there are not a great number of soils in New South Wales which contain as much as this, whereas the bulk of our soils contain considerably less. Liming is beneficial on a great variety of soils, and is to be regarded rather as a means of improving the land than as a direct plant-food. The soils on which it is particularly beneficial are the following:—

1. Soils deficient in lime.
2. Sour soils, on which it acts as a sweetening agent, neutralising the soil-acidity. On land which is newly opened up, or land which is being reclaimed from swamps, the addition of lime is an essential.
3. On stiff clay soils. The action of lime on this class of soils is to lighten them and render them more friable and amenable to tillage operations.
4. On sandy soils, lime acts in an opposite manner, as will be shortly explained, consolidating them and increasing the cohesive and capillary power of the soil.
5. On land which is destined for leguminous crops, or such crops as are specially benefited by the presence of lime, such as sugar-cane, maize, etc. Where a green crop is sown to be ploughed under, "green manuring," the previous application of lime to the soil is of the greatest benefit in promoting the growth of the green crop.

Nature of Lime.

Burnt-lime, stone-lime, or quicklime is obtained by burning limestone (carbonate of lime) in kilns of special construction. In the process of burning or calcining, carbonic acid and water are driven off, and the burnt product is pure lime (calcium oxide) of greater or less purity according to the purity of

the original stone. Other substances, having the same composition as limestone, also yield lime on being burnt, such as chalk, marble, shells, &c. If the lime has been properly burnt it forms a very hard, stony substance, nearly white, which slakes, or combines with water, with great avidity, crumbling to a fine white powder, and evolving sufficient heat to convert a part of the water into steam. In slaking, it combines with water, slaked lime being a hydrate of lime. As its function in the soil is principally mechanical, a test of its goodness lies in the readiness and completeness with which it slakes. Both under-burnt and over-burnt lime slake badly, though from different causes.

When liming is recommended for a soil it is always burnt-lime, either powdered or freshly slaked, that is intended. Many substances used as manures contain lime, but in these cases the lime is in combination with other substances and has not the same action on the soil as burnt-lime. For example, bone-dust and superphosphate both contain considerable proportions of lime in combination with phosphoric acid as phosphate of lime. Neither of these substances, however, have any effect in lightening clay soils, or in sweetening sour ones. In the same way chalk or "mild lime" (carbonate of lime) and gypsum (sulphate of lime) are all substances rich in lime, and valuable additions to the land in certain cases, but their action is not that of burnt-lime and they are not to be used when liming is recommended. Wood-ashes also contain carbonate of lime and have also a considerable value as fertilisers. Thomas' phosphate contains free lime, and there is no doubt that it has a considerable effect in altering the texture of heavy clay-soils, but none of these substances are to be substituted for burnt-lime.

Action of Lime on Different Soils.

The action of lime in the first place is a mechanical one, in altering the texture of the soil, and with it those properties which depend upon its texture, such as its absorptive power for water, its amenability to tillage operations, etc. The action of lime upon a clay soil may be illustrated by the following experiment:—If a small quantity of a heavy clay be mixed with water in any suitable vessel, it will form a muddy liquid. If a little lime be added to this, and the mixture well shaken, it will be noticed that the solid matters sink to the bottom in a loose powder, and in a short space of time, if the water is poured off and the soil dried, it can be readily broken up by the fingers. If no lime had been previously added, the clay, on drying, would form a hard mass, difficult to break up. This action, which is due to the power that the lime has of coagulating the fine particles of the clay, is identical with what takes place on the larger scale when lime is added to the field.

The presence of lime also prevents the shrinkage which wet clay soils undergo on drying, and which causes the cracks and fissures seen on the parched clay-soil. The admixture of lime to a clay, therefore, prevents the formation of a sticky mass when wet, and a cracked, parched appearance when dry.

Limed land is drier and warmer, more friable, and consequently more readily cultivated. Land which has been limed is ready for the plough sooner than unlimed land.

On light, sandy soils the action of lime is also strikingly beneficial in binding the particles of sand together, and increasing the cohesive and capillary power of the soil. Its action is, in fact, exactly that of lime on sand in the mixing of mortars, only on a much modified scale, since for making mortar the proportions are one part of lime to three or four parts of sand, whereas the addition of a ton of lime per acre represents one part of lime to nearly 20,000 parts of sand. The action of the lime is the same in both cases—on drying it absorbs carbonic acid from the air, forming carbonate of lime, which cements the particles of sand together; forming, in the proportions used in making mortar, a hard compact mass, and, in the case of the soil, increasing its cohesiveness and its power of retaining water.

Lime, therefore, lessens the cohesiveness of clay soils, and increases that of sandy soils—two properties which are apparently opposed to one another; in fact, there are few soils the mechanical texture of which is not improved by liming.

The action of slaked lime is exactly the same as that of stone or quick lime, but not so pronounced, and it is generally preferable to use the lime unslaked, or only slightly and freshly slaked.

Chemical Action of Lime.

Apart from the above mechanical property of lime in improving the texture of the soil, it has also a chemical action, and though this is not thoroughly understood, it may be classed under the following headings:—

Firstly, it neutralises the acids sometimes present in soils. Sour soils contain free acids present in such quantities as to be injurious to plant life, and such soils are "sweetened" by the application of lime—that is to say, the free humic and similar acids are neutralised.

Secondly, it attacks the inert organic matters in the soil and promotes fermentation—one of the most active agents in the production of available plant-food. It is, of course, possible to have too much of a good thing, and an excessive dressing of lime would tend to burn up the vegetable matter of the soil, and do as much harm as good; but in the moderate dressings recommended, it will be found beneficial even on land which has lately been green-manured. It must not be forgotten, however, that the action due to caustic lime soon ceases, for it is very rapidly converted into carbonate of lime within the soil, which has no such action on organic matter.

Thirdly, it attacks the insoluble mineral constituents of the soil to some extent. This is notably the case with potash, which is set free from its insoluble compounds, such as felspar, and rendered available as plant-food. Phosphoric acid also enters into combination with lime, and is, in this form, more readily utilised by the plant than in its

insoluble combinations with iron and alumina, with which it is associated in the soil. Owing to the tendency of lime to burn up a portion of the organic matter, its benefit is more marked on soils rich in organic matter.

Fourthly, carbonate of lime (into which we have seen the lime is soon converted in the soil) is beneficial, if not necessary, to the process of nitrification, the peculiar ferment action by which the inert soil-nitrogen is converted into nitrates.

Fifthly, whilst it promotes certain ferment action, such as the above, it hinders the active growth of many fungoid diseases like rust and smut, and is said to be often a cure for such diseases.

Methods of Application.

Lime may be applied in two ways—either as ground lime or freshly slaked. As ground burnt-lime it is applied at the rate of 5 to 6 cwt. per acre in a manure-distributor and lightly scattered over the surface. If freshly-slaked lime is used it is applied in somewhat larger quantities up to ½ ton per acre, or even more in the case of very stiff clays. The heavy dressings once employed are found to be less beneficial than smaller applications more frequently applied.

Liming with freshly slaked lime is best carried out as follows:—The quick-lime (stone-lime) is broken up into smaller lumps and placed in heaps about the field covered with moist loam. It is left exposed to the air and moisture until it begins to crumble to powder. As soon as this happens the heaps are scattered with a shovel as evenly as possible over the surface of the field, and harrowed or ploughed in very lightly. Liming is most effectively done in the autumn or winter, but whenever it is done the land should be left alone for two or three weeks after the application, and no seed sown nor any manures (especially such as contain nitrogen or superphosphate) used during that period.

Other Lime Compounds.

Carbonate of lime is used in several forms—such as chalk, unburned limestone or shells, and "mild" or "agricultural" lime, which latter is old burnt lime which has been exposed to the air and become converted into carbonate by absorption of carbonic acid. Its addition to the soil promotes nitrification, sweetens sour soils, and prevents clay soils from puddling, though it is less powerful in the latter respect than burnt lime. It is milder in its action and, as a rule, burnt lime is to be preferred.

Gypsum or *plaster* (sulphate of lime) may also be sometimes used to advantage. Its action, apart from its action as a direct plant-food on soils poor in lime, appears to consist in setting potash free from its insoluble combinations in the soil, hence it is most useful on soils rich in potash, and for such crops as clover it is of especial service. It is best applied moist or in wet weather at the rate of 2 to 3 cwt. per acre. Gypsum is also often used as a "fixer"—that is to say, when added to dung or urine or decaying animal and vegetable matter, it decomposes the carbonate of ammonia which

is being continually evolved from such substances and converts it into sulphate of ammonia, in which form ammonia does not escape into the air. If a heap of dung, from which the odour of ammonia is perceptible, be mixed with a few shovelsful of moist gypsum, the smell will be found to have disappeared—in other words, the ammonia is "fixed," and its loss prevented.

Gypsum is also of great value in lands which are charged with alkali, or irrigated by alkaline water. For this purpose it is either sown on the land in proportions depending upon the amount of alkali in the soil, or it may be introduced in boxes in the irrigation sluices, or added to the tanks if the water is stored.

Meteorological Conditions for September, 1906. Comparison with India.

H. A. HUNT,
Acting Meteorologist, Sydney.

The cablegram showing briefly Meteorological conditions over India during September, has only just come to hand. The following statement shows a comparison with results for New South Wales, during the month just ended.

	Departures from Normal Pressure.	Departures from Normal Temperature.	General Conditions (referring to State as a whole).
Simla (India)	·02	0·2	Moderate excess.
Sydney (N.S.W.)	·004	0·8	Considerable excess.

The words "moderate" and "considerable excess" refer to rainfall. The above data again show an interesting coincidence, pressure and temperature being in defect, while rainfall was in excess over both these widely separated regions. September forms the third consecutive month during which Meteorological conditions over India and New South Wales have been somewhat similar.

The rainfall in New South Wales during September was mainly the result of four storms, lasting as follows:—

From 1st to 7th.
,, 8th to 14th.
,, 15th to 26th.
,, 27th to end of month.

Taking the month as a whole, rainfall distribution over the State has again been remarkably good. Over the greater part of the State the total fall has been considerably above normal, especially over districts west of the mountains, where excesses were recorded from 400 to 600 per cent. above the average. Coastal districts, however, show a moderate defect, only between the Manning and Clarence Rivers has the fall been above the average.

Rabbits and Ants.

WALTER W. FROGGATT, F.L.S.,
Government Entomologist.

DURING the last few months we have had a great deal of interesting information in the newspapers about the value of the "Red" or "Meat" ant of Natal, and, incidentally, stories of other African ants that can even eat elephants. A gentleman engaged in press-work in Johannesburg took up the question of growing rabbits for profit in South Africa, but finding they did not thrive, looked round for the cause, and satisfied himself that it was the presence of a subterranean "meat ant" getting into the burrows and devouring the helpless young that was the cause of his discomforture. Prompted by the knowledge that fame and fortune awaited the man who could exterminate the greatest pest that has ever reached Australia, the common wild rabbit of Europe, he wrote letters to that great authority on ants, Lord Avebury, better known to naturalists as Sir John Lubbock, and sent copies of them and his account of his experiences in South Africa to various firms in Australia that he thought were interested in the matter. Several of these communications came into my hands, though Mr. Blackburn never wrote directly to me, and my letter of inquiry addressed to him in South Africa, was returned with the information that he had gone to London.

Before going into the history of this particular ant, which it was proposed to introduce into New South Wales to devour rabbits, I would point out that Australia has a wonderfully rich ant fauna, for there are over five hundred distinct species of ants described from Australia, and there are many more undetermined species yet to be examined and named. The dry interior where Brere Rabbit flourishes to such a wondrous extent is infested with many species, and one which forms large ant-beds containing countless swarms of savage little creatures, is popularly known as the "meat ant," and woe-betide any weak, injured, or sick creature that falls on the ground in the vicinity of one of these ant nests; it will be literally eaten alive if no one comes to its assistance. I have seen them swarming over the remains of dead rabbits and carrying away the bits of flesh piecemeal, but it does not trouble the living ones.

Again, we have the fierce "bull-dog" ants, which take their popular name from their characteristic habit of hanging on to their enemy when they get a grip with their powerful toothed jaws, like the British Bull-dog; but, unlike that much-praised animal, they do not play fair, for as soon as they come to close quarters they turn the tip of the abdomen downward and stick a powerful horny sting into the softest spot they can find, and this has been likened to the prick of a red-hot needle.

About forty species of this group (*Myrmecia*) are described from Australia, and four or five are quite common enough in the neighbourhood of Sydney. They form vertical shafts in the ground. only protected by a ring of earth or low mound, each colony containing a family of about a hundred members, though some well-established nests may contain more. They are essentially foraging ants, hunting over the ground, climbing up and down the trunks of the trees in search of all kinds of food, showing a great fondness for sugary secretions.

Not only is a pedestrian liable to stand on one of these inconspicuous nests when wandering through the bush, and thus hurt the feelings of the bull-dog ant, but he will easily shake one down on to his neck from an overhanging branch when forcing his way through the low scrub. I know of no greater disturber of the harmony of a picnic party than a nest of angry bull-dog ants, when the table-cloth has been spread in the vicinity of their nest; and such a catastrophe can happen anywhere in the summer around Sydney.

In the tropical jungle of Cape York, the green tree-ant forms large irregular nests among the foliage of the trees, webbing the leaves together with a silken substance they obtain from their own larval ants, in which large communities dwell and forage all over the forest. They capture and devour all the smaller defenceless creatures they come across, and have a pair of very powerful jaws by which they can hang on to their enemy while they turn the tip of the body upward and squirt a drop of acrid fluid into the spot where their jaws have lacerated the skin, and thus intensify the pain of the bite—what the school boy might describe as " rubbing it in."

A gentleman residing in Queensland has now furnished me with an account of another Australian ant (luckily confined for the present, as far as we know, to one part of Thursday Island, north of Cape York). He says: " In a recent issue of the *Brisbane Courier* I noticed a clipping taken from the *Sydney Morning Herald*, dealing on the subject—' Red or Rabbit-eating Ants.' I have resided for twelve months on Thursday Island, on a portion of it that was infested with an ant of a similar kind, if not the very identical ant. The only doubt of their identity is that the size is not mentioned. The Island ant is a small species, the size of the little brown ant that infests our houses and larders; its colour is bright reddish-brown. It has a very hard head, and the rear section of its body is inclined to be darker than the foremost portions. The sting of this ant is something similar to the point of a red-hot needle being thrust into you, leaving a white lump as the after effect of the sting. Like the South African ant, it attacks any young animal or bird, such as young chicks coming out of the shell; their sting being so fierce that it would take the ants no length of time to destroy a whole clutch. The hen while sitting is often attacked, and I have had a hen get such a doing that she would never attempt to return to the nest. The ant usually attacks the rear unfeathered portion of the body. I eventually found a remedy in creosote: I placed the box on four legs, about 6 inches from the

ground, bound the legs with some absorptive material and then painted it over with the cresote. The ants never attempted to go over this check, and I experienced no further difficulty in rearing chicks. A sick or maimed one is a great prey for these ants; they attack it in myriads, and it is no time before the chicken's misery is ended. We have often been attacked at night when in bed, and the only way we could ensure a night's rest was by placing the legs of our beds in tins filled with creosote. The wardrobe was another favourite resort of the ants; then they would riddle your garments as a mosquito-net. Some new windows in the house were another source of attraction; the putty was all destroyed, the ants swarming in hundreds after the oil. To make my house habitable I was compelled in the long run to paint with creosote 6 inches of the stump under the cap, and any part of the house connected with the earth. This baffled them for a time, but to my surprise I found them coming in on the clothes-line which was attached to the house. A little creosote rag tied round the wire prevented their attack from this quarter. A piece of straw from the broom falling against the house and giving connection to the ground was another inlet; also string from the grocer's parcels falling against the house. Previous to my having the blocks smeared we could not sit down to a meal without being tormented by the ants. They would ascend the table legs in great numbers and soon be over all the food on the table. Strange to say, about 100 yards from my house a neighbour lived, and this ant never bothered him; but he had swarms of the little brown house ant, and I think the little brown ant kept their red brethren at a distance. The red ant seemed to exist in a belt running north and south through the island. Houses on either side of the belt were entirely free from them; but the brown species were in great evidence at these places. If a child is placed on the floor where the red ant abounds it would soon be attacked, and the shock from the effects of the stings would in nine cases out of ten cause death. Seeing that you are in communication with the authorities in South Africa, with a view to importing this ant, I thought an account of the Thursday Island specimen would be useful and interesting to your purpose; for this reason I thought I should communicate with you on the subject. I noticed in dull or cool rainy weather this ant disappeared, but as soon as it became bright and sunny they would come forth in millions, and any bone lying about the yard would be literally red with them."

In conclusion, he says: "I do not think this ant would thrive in cold climates, therefore I think it would be a failure trying its importation. Further, it would certainly be a pest to mankind."

This Thursday Island ant seems quite capable of settling the rabbit question, if its sphere of usefulness was extended to the mainland; but I think it would be advisable to take all precautions to keep it in its island home.

I have been unable to obtain the identification of the Natal red ant, or any knowledge of its habits under that name, from the Government Entomologists of Cape Town or Transvaal, but condense the following account

of its habits by its discoverer, who now offers it to the landholders of Australia:—

Mr. Blackburn's statement is that about ten years ago he took up the artificial breeding of rabbits in hutches, and found them do very well; but as soon as he turned the rabbits into enclosures the increase fell off, and several large lots turned out on to the veldt near Johannesburg gradually disappeared, and within twelve months after 700 had been liberated at Saxenwold Estate "a rabbit was the rarest item in a day's bag."

In 1901 he commenced, and carried out further work in the acclimatisation of rabbits in Natal, and persuaded about twenty-one farmers to take up the work, in all parts of Natal, Transvaal, and Orange River Colony; but the results were all the same, rabbits of all kinds failed to take any hold in the country.

He explains his want of success in rabbit-breeding in the following words: "After about twelve months my enclosed rabbits at Loteni practically ceased to breed. I dug up a number of burrows and found the secret: the newly-born rabbits were covered with red ants. I communicated with all the farmers experimenting; they found the cause of the non-increase was the red ant. The cause of the almost entire absence of small furred animals in red-ant districts was explained. I found that the meerkat, the dassie (a species of rabbit), the cane rat, and the sprenghaar (a species of hare), were very scarce in red-ant areas: and they all make their nests in rocky places, too hard for the ant to burrow in. It is also noticeable that rats and mice are rare on farms in the veldt, when they swarm in the towns. I noticed, and the Kaffirs confirm the view, that all animals born without hair are subject to the attack of red ants."

Though this gentleman claims that this ant will only act as a scavanger, and destroy animals born without hair, and that he has never seen it attack lambs, it seems very inconsistent, to judge from its habits as he describes them. From the statements he puts forward this ant ought to be well known all over South Africa; but it is quite unknown to the economic entomologists as a useful insect.

The following information regarding ants, and the reasons that rabbits have never become a pest in Africa, are given by Mr. Charles P. Lownsbury. He says: "The insect in question is unknown to me, at least under the name given, and it is highly improbable that it has anything to do with the present immunity of South Africa from the rabbit plague. I have asked Mr. Peringuey, the Curator and Entomologist at the South African Museum, if he knows of an ant with such a name, and he is of opinion that *Dorylus helvolus* is intended. This species is generally associated here with old dwellings, in making its appearance in great numbers at times from beneath the floors. Between these swarming times it is rarely seen, but Mr. Peringuey says that he knows it can be attracted by a buried bone, and that it greedily takes to meat. Rabbits were introduced to the Cape within a few years of the first colonisation, over 200 years ago, but there seems to be no record of

them having thrived except on one or two islands. The Cape has some sort of rabbit law enacted with a view of preventing the country becoming overrun with the creatures; but I have no hesitation in saying that it is not this that saves us, as I have met a number of people who keep rabbits for pets who were ignorant of the law, and as escapes must have taken place times without number. Mr. Peringuey, indeed, says he has seen some on the downs near Cape Town, and has known many to be set at liberty. The reason we have never suffered from rabbits is believed to be the prevalence of small carnivora—jackals, pole-cats, and the like. In this regard, see the paragraph on the striped muishond (*Zorilla striata*), in F. W. FitzSimon's article on 'The Wild Animals of South Africa,' in the issue of the *Natal Agricultural Journal*, dated February 28th, 1906. He mentions that he turned a large number of rabbits loose on his land, and that they multiplied very rapidly for a while. Then a few of these pole-cats took up their quarters in the vicinity, with the result that the bunnies rapidly diminished in numbers. Of course, the pole-cats are quite as fond of fowls as of rabbits, and probably the introduction of such a check on rabbits into Australia would be followed by a very complicated readjustment of bird life, and, perhaps, snake life as well. I think our sheep farmers would be quite willing, were it possible, to exchange their jackal curse for your rabbits. By the way, jackals burrow, as do moles also: and I do not see why the meat ants should leave them in peace."

Mr. C. B. Simpson, Entomologist to the Transvaal Department of Agriculture, in reply to my letter asking him for information regarding the red ant, sent me the following information:—"I have looked up the question for you, but am unable to give you the scientific name of the ant in question. It is called the "red ant" by the farmers, and often causes much trouble. They infest houses, bite people severely, will carry away any sort of meat, and it is reported that they have killed a canary in its cage. Further, I know of a house that has its verandah infested, and the ants are so numerous and active that the people cannot stay on the verandah cn account of bites from the insects. They also worry their dogs. I had an instance told me of where these ants caused the destruction of mice in their nests, but as there are no true rabbits in the Transvaal I cannot give you any observations about these insects attacking these animals. Our hares, of course, do not make burrows, and the young are active very soon after birth. I shall keep this question in mind and endeavour to secure some of these ants for you, and if you would wish, after this information I have given you, to attempt an importation of them into Australia, I will give you all the assistance in my power."

I need not say that I at once informed Mr. Simpson that I had no intention of introducing "red meat-ants" into my native land, even before I had his report upon them; but at the same time I asked him for specimens in spirits so that the species could be identified or described.

There are many curious tropical ants, both in Africa and Central America, that are known as most serious pests, that can destroy everything before them, such as the "Driver ants" (*Anomma arcens*), noticed by every traveller and explorer in Equatorial Africa. Dr. Savage, who resided for some years in Sierra Leone, and took a keen interest in natural history, has written some interesting accounts of this insect. These ants do not form a nest like most species, but are "freebooters" of the old English type who harried the border towns, camping their armies at the butt of old trees or logs, when at rest, but hunting all over the country for their food. Writing in 1847, Savage says: "They keep down the more rapid increase of noxious insects, and small reptiles, consume much dead animal matter and refuse. The dread of them is upon every living thing. They will destroy even the largest animal if confined," and he saw them kill and devour a snake over 4 feet in length close to his house.

Bates tells us of a "fire ant," called "Formiga de Fogo" (*Myrmica saevissima*), which makes its nest in sandy patches on the upper reaches of the Amazon River in Brazil, which, when it comes into the natives' clearings, takes possession, and the natives simply abandon their huts and move on.

In Southern Texas and Central America, *Atta cephalotes*, known as the "Sauba" or Umbrella ant, builds immense excavations underground, and passages so deep and broad that they sometimes extend beneath large rivers. It is a terrible pest in orchards or gardens, stripping every bit of foliage off the plants, and there are many men in these districts that are professional ant diggers, employed to destroy these underground ant beds, and who do nothing else.

About two years ago Mr. O. F. Cook, of the Washington Department of Agriculture, while engaged on botanical work in Guatemala, Central America, discovered a local ant, called the "Kelep" by the natives, which it was claimed by them, devoured the cotton-boll weevil so efficiently that it was no pest to the growers wherever these ants were established. This little snout-beetle some years before had been introduced from its native home in Mexico into the United States, and spread over the greater part of the cotton fields of Texas and Louisiana. Mr. Cook, seized with the parasite theory, immediately set to work to collect and transport colonies of these ants into the infested States, and bred them in the laboratory at Victoria, Texas. Since the introduction of these ants, some 4,000 in number, some persons in the State applied for an injunction against the Department of Agriculture to stop them from distributing such an insect broadcast in the country. I have seen no fresh news as to whether these ants were liberated in the fields, or what have been the consequences to the weevils.

It is probable that our African correspondent noted this experiment when studying the red or meat-ant of Natal. The question of introducing ants to kill weevils on cotton fields, however (even if successful) is a very different matter when we talk about spreading them over the vast area inhabited by the rabbit in Australia at the present time; even if they could be collected

in sufficient numbers to send them in a continuous stream for a year or two, how long would it take to be effective, even if this ant only attended to rabbits and left all other insects, animals, and birds alone? Then our bull-dog ants, and meat or mound ants, would have to be reckoned with. They are in possession; both burrow in the ground and would probably take a hand in destroying any interloper into their domains. The balance of power that would be upset by such an assisted emigrant, if in spite of all difficulties it did establish itself, might be quite as serious as the rabbit; for when the last rabbit had vanished, the whole of Australia would be honeycombed with the nests of an ant, described in such terms by the Government Entomologist of the Transvaal, that life in the Australian back blocks would be hopeless, and the settler could not retailate by eating the ants.

The rabbit is bad enough, but the ant would be worse; and this Department would certainly resist any attempt made by anyone to introduce these ants into Australia, as I am informed it has been proposed. The introduction of the mongoose into Jamaica many years ago by the sugar-planters to destroy a rat that did a great deal of damage by gnawing the sugar-cane stems, is a very interesting story of how the balance of power can be upset. The introduced mongoose soon settled up the rats, but when they were gone the mongoose still had to eat, and all the ground animals, birds, and reptiles followed in the wake of the vanished rats. Still the mongoose, without any natural enemies, increased, and the food supply was gone; then poultry and domestic animals came into the bill of fare of the hungry mongoose. The inhabitants had to kill the mongoose. Just then the scrub tick took a hand in the game, and the mongoose was doomed. The few survivors of the native fauna began to show up, and according to latest reports to hand things were coming back to normal conditions.

Period of Gestation of Farm Animals.

Mare	Forty-eight (48) weeks (about).
Cow	Forty (40) weeks (about).
Ewe	Twenty-one (21) weeks.
Goat	Twenty-one (21) weeks.
Sow	Sixteen (16) weeks.
Bitch	Nine (9) weeks.

Period of Incubation of Domestic Birds' Eggs.

Muscovy	Thirty-five (35) days.
Goose	Thirty (30) days.
Duck	Twenty-eight (28) days.
Turkey	Twenty-eight (28) days.
Fowl	Twenty-one (21) days.
Pigeon	Eighteen (18) days from last egg.
Canary	Thirteen days from steady sitting.

Dairy Notes.

Observations by a Dairy Instructor.

C. PEDERSEN.

ALTHOUGH we have made some progress in the dairying industry during the last few years, such progress has been most marked in quantity and uniformity. It must be admitted, very little, if any, headway has been made in the direction of quality, and we must give the factories credit for the improvement made in the uniformity; but it seems as if we have reached a stage in the manufacture, as far as quality is concerned, of "mark time," a position we should not and need not remain in.

With other farm products at fairly low prices, not only in Australia, but in other parts of the world, do we not stand the chance of being pushed back from our present position instead of advancing.

We can make a higher quality butter, even under the home separator system, than we are making to-day; but to reach a higher standard, our dairy farmers and factory directors must take more interest in the industry in which they are engaged.

From my observations I have come to the conclusion that the average farmer takes very little interest in his dairy business, beyond his cows. Equally important to the stock is the milk and cream, but these are sadly neglected. Since the introduction of the private separator, the dairyman became directly responsible for the quality of butter we produce, owing to all the handling of the cream up to the time of churning having been done while in his charge, including the ripening process, which is the most important part of butter-making. All the work leading up to the time the cream reaches the factory—such as milking, separating, cooling, and ripening the cream,—has an important bearing on the quality of the butter; and I must say such work is not done with that care, cleanliness, and neatness that is needed for the production of a high-quality butter.

There are many careless acts committed by our dairymen. First, in the milking-yards and during milking, the fine dirt that finds its way into the milk, where water is not used to clean the udder and milkers' hands, has more to do with pulling down the fine flavour of butter than one would imagine. Next comes the separator: it is surprising the number of dairymen who have fallen into the careless way of not cleaning the separator at night after having finished separating, nor before separating the next morning. Careless is a mild word for such an offence. I have come to the conclusion that the

word cleanliness in connection with the manufacture of butter is not understood by those who in particular should know what cleanliness means. If we could make up our minds to produce clean milk, then we would be on the right road to a better and higher class of produce.

Suitable Factory Buildings.

Although the industry is firmly established, factory directors do not seem to look at it in that light; a number of new factories have been erected during the last few years, but few of them can be called up-to-date factories. Many things have to be considered in designing a factory, for convenience and necessity. It is a rare thing to see a cool-room in which to work the butter, although this is important in a climate like ours. Butter should not be allowed to go soft on the worker after it is churned, but should be kept firm; it is an inconvenience to the butter-maker, and a loss to the company. A semi-insulated room is all that is required, because a low temperature is not needed; a temperature of 60 degrees Fahr. will keep butter firm on the worker. Another point overlooked is the size of the working rooms; they are as a rule made too small. All dairy buildings (including dairies on the farms) should be so large that the work can be done without coming into contact with the walls, otherwise splashes will continuously reach the walls, and it is not an uncommon thing to see these in a bad state of cleanliness.

How Dairy People should be dressed.

Up to the present, hygiene has been completely overlooked in regard to the dress worn by those engaged in the industry; not only by those doing the milking and separating, but by those working in the factories and coming in direct contact with the butter. I should not like to describe the different class of dress and dresses one meets with in factories and milking-yards; but taking them as a whole, they are most unsuitable.

Why should we not, handling as we do a delicate article of food, pay a little more attention to our dress while handling such food stuff? The dress worn should be able to stand hot water and washing soda; and the best for the purpose is dungaree suits for men, and butcher blue linen dress for women.

Cheese for Export.

W. GRAHAM.

In the event of cheese being exported from New South Wales this incoming season, and there is every probability of this being the case, owing to good prices offering in the London market, and as the majority of cheese factories in New Zealand have already sold their season's output to London houses at

6d. per lb. at the factory's door, I think some effort should be made to secure some of the good things our neighbour is enjoying, and also relieving the pressure of our local market.

Some of the following hints will be of use to factories who are intending to export some of the incoming season's make. Cheese suitable for the London market should be mild in flavour, with a close meaty body. To obtain the mild flavour desired, good clean milk will be necessary, and the amount of acid at wheying-off will have to be considerably less than what is generally given in the ordinary run of factories in this State at the present day, more so in the spring-time; an eighth of an inch on the hot iron will be ample.

To secure a close meaty body, the curd should be well cooked in the whey, coupled with a good two hours cheddaring before milling, a good airing before salting, with the acidity well developed.

In reference to colour, the demand in the London market is generally for a white cheese, although a small proportion of coloured will often bring a good price. It is advisable to ship in the proportion of two-thirds white and one-third coloured. The colour in a coloured cheese should not be high; three-quarters of an ounce of colouring to 100 gallons of milk is sufficient to obtain the desired straw colour.

The weight of the cheese should be about 70 lb. The size of the hoop required to make a cheese of that size will be 14½ inches in diameter, and 14 inches in depth.

Cheese for export should be packed in crates, the ends of the crates octagon-shaped, made of inch timber with a breadth or diameter of 15 inches, the timber joining the sides of the crate should be 32 inches long by 3 inches broad, and a quarter of an inch in thickness. Crates made from timber of these dimensions will hold two cheeses, with a centre-piece half an inch in thickness cut exactly the same shape as the end pieces. This prevents the two cheeses sticking together, and also helps to strengthen the crate. It is also advisable to bind the ends of the crates with thin wire, so that they will stand the rough usage during transit. The name of the factory should be branded plainly on each end of the crates, also the words "Full Cream Cheddar Cheese, New South Wales, Australia," also the weight of the cheese in pounds net. The age of the cheese at the time of shipping should be from ten days to a fortnight old—as the cheese will be six week in transit, it is not advisable to have them more than a fortnight old.

The temperature during transit should be an even one of 50° Fahr.

Manure Experiments with Wheats at the Bathurst Experimental Farm.

R. W. PEACOCK.

DURING the past four years a number of experiments with various commercial fertilisers were carried out.

It was not deemed expedient to publish the results as they became available. From the experiences gained throughout the past four years, from the various experiments carried out upon different portions of the farm, I am of the impression that a comparatively accurate opinion may be given as to the requirements of the wheat plant upon the soils of the farm, which are typical of the majority of the wheat lands of the district. Such a report as the following must be regarded in the light of a progress report, and may have to be modified slightly in the course of future experiments. There are so many factors to be taken into consideration that any opinion now expressed may, under a different set of conditions, require modification.

It will be seen that the past four years have been considerably below the average as regards rainfall. In no instance, even in what may be termed the good season, viz., 1903, has it reached the average for the district. Throughout the whole period the soil was never super-saturated, and no leaching or waste of plant-food from that cause occurred. Upon a recurrence of normal seasons it is only reasonable to expect that some loss from such may occur, and, with an abundance of moisture, ingredients which have not during the period under review given very positive results, may do so.

In order to arrive at many of my conclusions, I have taken the experiments collectively, and have refrained from giving all the individual results of the plots, as such would make the report too voluminous.

A plan of each experiment and the manuring of each plot is given, and in every instance land was chosen with the greatest apparent uniformity. Unfortunately the soils at this farm vary considerably, and such variation has interfered with some of the experiments.

The result has been that portions had to be eliminated as unreliable, and only those which allow of reasonably accurate comparisons have been tabulated.

Experiments A and B were planned by Mr. F. B. Guthrie, Chemist of the Department of Agriculture, and Mr. R. Helms; and have been supervised in every particular by Mr. Helms.

In Experiment A the land in blocks 2 and 3 was found to vary so much as to interfere with comparisons, and the results have not been given. Owing to this the experiment was revised in 1903, and removed to another paddock and formed the Experiment B.

Experiment A was manured only in 1902, and the results were calculated during that season and the following three, and formed the basis of the experiment to test the lasting effects of the various applications which are shown in Table 4.

Table 1 contains the mean yields of Experiments A, B, C, and D, the various ingredients being used in different proportions in some of the experiments, as will be seen byreferring to the manures applied in these experiments.

Block 3.

21c	22c	23c	24c	17d
24b	17c	18c	19c	20c
19b	20b	21b	22b	23b
22a	23a	24a	17b	18b
17a	18a	19a	20a	21a

Block 4.

29c	30c	31c	32c	25d
32b	25c	26c	27c	28c
27b	28b	29b	30b	31b
30a	31a	32a	25b	26b
25a	26a	27a	28a	29a

13c	14c	15c	16c	9d
16b	9c	10c	11c	12c
11b	12b	13b	14b	15b
14a	15a	16a	9b	10b
9a	10a	11a	12a	13a

Block 2.

5c	6c	7c	8c	1d
8b	1c	2c	3c	4c
3b	4b	5b	6b	7b
6a	7a	8a	1b	2b
1a	2a	3a	4a	5a

Block 1.

Plan of Experiment A.

Paddock No. 6. Area of plots, $\frac{1}{10}$ acre—1 chain x 1 chain.

Table 2 gives the results of the different manurings in a good season—the year 1903 being taken, as the rainfall proved suitable notwithstanding that it was below the average.

Only Experiments A, B, and C are taken. In the case of Experiment A the manures had been applied the previous year—1902; the results therefore are not so striking as in B and C.

Table 3 gives the results of the manurings in dry seasons—1902, 1904, and 1905 being taken; 1902 was the year of the disastrous drought, and only 14·83 inches were recorded. In 1904 18·26 inches fell, whereas in 1905

18·57 inches were registered—these two last being considerably below the average. Experiments A, B, D, and E are taken. Experiment A was only taken for the year 1902—the season the manures were applied.

Table 4 is based upon Experiment A, the manures being applied in 1902, and the results noted for four seasons. It is regrettable that the results of Block 4 of Table 5 are not comparable, owing to the differences of soil in the two blocks.

Table 5—the results of these applications unfortunately cannot be compared with those of the other blocks as was originally intended, and are given because in themselves they are interesting, and show the results due to heavy dressings of Thomas' Phosphate and the influence of the spring dressings. The results in other respects may be valuable in conjunction with future experiments in the same direction.

ANNUAL RAINFALLS at Bathurst Experimental Farm for previous four years.

	inches.		inches.
1902	14·83	1904	18·26
1903	21·68	1905	18·57

Average rainfall for 48 years, 23·97 inches.

MANURES applied to Experiment A, at per acre.

Block I—1902.

Plots 1a, 1b, 1c, 1d	No manure.
2a, 2b, 2c	60 lb. sulphate of ammonia.
3a, 3b, 3c	300 ,, superphosphate.
4a, 4b, 4c	30 ,, sulphate of potash.
5a, 5b, 5c	60 ,, sulphate of ammonia. 300 ,, superphosphate.
6a, 6b, 6c	60 ,, sulphate of ammonia. 30 ,, sulphate of potash.
7a, 7b, 7c	300 ,, superphosphate. 30 ,, sulphate of potash.
8a, 8b, 8c	60 ,, sulphate of ammonia. 300 ,, superphosphate. 30 ,, sulphate of potash.

MANURES applied to Experiment A, at per acre.

Block II—1902.

Plots 9a, 9b, 9c, 9d	No manure.
10a, 10b, 10c	60 lb. sulphate of ammonia.
11a, 11b, 11c	300 ,, superphosphate.
12a, 12b, 12c	30 ,, sulphate of potash.
13a, 13b, 13c	60 ,, sulphate of ammonia. 300 ,, superphosphate.
14a, 14b, 14c	60 ,, sulphate of ammonia. 30 ,, sulphate of potash.
15a, 15b, 15c	300 ,, superphosphate. 30 ,, sulphate of potash.
16a, 16b, 16c	60 ,, sulphate of ammonia. 300 ,, superphosphate. 30 ,, sulphate of potash.

Block II limed at the rate of ¾ ton per acre.

MANURES applied to Experiment A, at per acre.

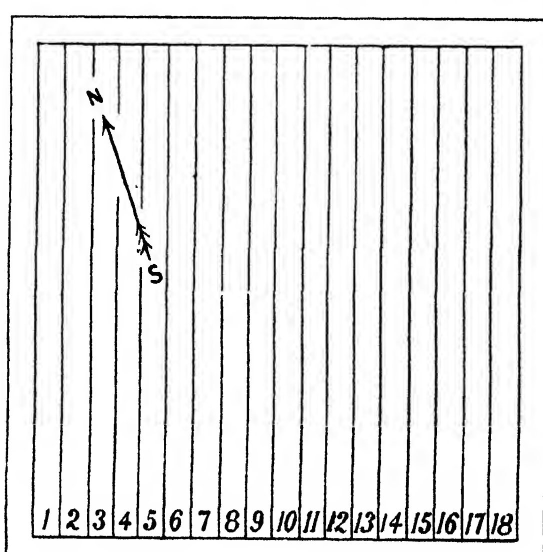
Block III—1902.

Plots 17a, 17b, 17c, 17d	200 lb.	superphosphate.
18a, 18b, 18c	100 ,,	superphosphate.
19a, 19b, 19c	50 ,,	superphosphate.
20a, 20b, 20c	140 ,,	rock phosphate (Florida).
21a, 21b, 21c	70 ,,	rock phosphate (Florida).
22a, 22b, 22c	300 ,,	Thomas' phosphate.
23a, 23b, 23c	200 ,,	Thomas' phosphate.
24a, 24b, 24c	100 ,,	Thomas' phosphate.

MANURES applied to Experiment A, at per acre.

Block IV—1902.

Plots 25a, 25b, 25c, 25d ..	140 lb.	rock phosphate (Pacific Island).	
26a, 26b, 26c ...	70 ,,	,, ,, ,,	
27a, 27b, 27c ...	300 ,,	Thomas' phosphate.	
	50 ,,	superphosphate, as spring dressing.	
28a, 28b, 28c ...	300 ,,	Thomas' phosphate.	
	50 ,,	superphosphate	as spring dressing.
	35 ,,	sulphate of ammonia	
	30 ,,	sulphate of potash	
29a, 29b, 29c ...	300 ,,	superphosphate.	
	60 ,,	sulphate of ammonia	as spring dressing.
	30 ,,	sulphate of potash	
30a, 30b, 30c ...	300 ,,	superphosphate.	
	100 ,,	dried blood	as spring dressing.
	30 ,,	sulphate of potash	
31a, 31b, 31c ...	300 ,,	bonedust.	
32a, 32b, 32c ...	200 ,,	bonedust.	

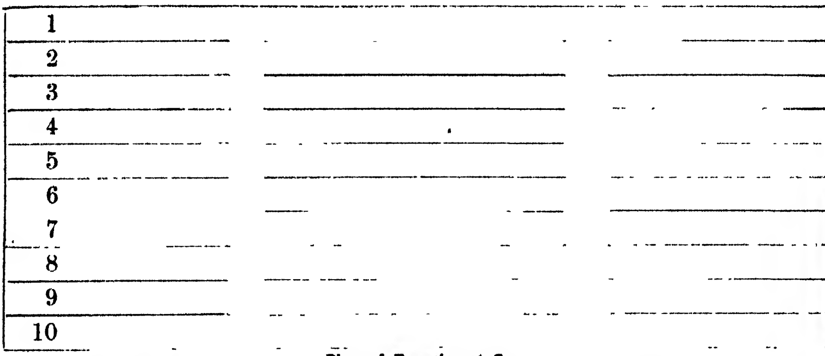


Plan of Experiment B.

Paddock No. 4. Area of plots, $\frac{1}{20}$ acre—9 chains x $\frac{1}{2}$ chain.

MANURES applied to Experiment B, at per acre.

No. of Plot.	1903.	1904.	1905.
1	No manure	No manure	No manure.
2	60 lb. sulphate of ammonia ...	60 lb. sulphate of ammonia ...	35 lb. sulphate of ammonia.
3	200 lb. superphosphate	200 lb. superphosphate	150 lb. superphosphate.
4	30 lb. sulphate of potash ..	30 lb. sulphate of potash ..	20 lb. sulphate of potash.
5	200 lb. superphosphate ... 60 ,, sulphate of ammonia ...	200 lb. superphosphate ... 60 ,, sulphate of ammonia .	150 lb. superphosphate. 35 ,, sulphate of ammonia.
6	60 lb. sulphate of ammonia . 30 ,, sulphate of potash	60 lb. sulphate of ammonia .. 30 ,, sulphate of potash .	35 lb. sulphate of ammonia. 20 ,, sulphate of potash.
7	200 lb. superphosphate .. . 30 ,, sulphate of potash ..	200 lb superphosphate ... . 30 ,, sulphate of potash ...	150 lb. superphosphate. 20 ,, sulphate of potash.
8	200 lb. superphosphate . 60 ,, sulphate of ammonia . 30 ,, sulphate of potash ..	200 lb. superphosphate .. .. 60 ,, sulphate of ammonia .. 30 ,, sulphate of potash .	150 lb. superphosphate. 35 ,, sulphate of ammonia. 20 ,, sulphate of potash.
9	No manure	No manure	No manure.
10	100 lb. superphosphate .	100 lb. superphosphate	100 lb. superphosphate.
11	50 lb. superphosphate	50 lb. superphosphate	50 lb. superphosphate.
12	140 lb rock phosphate ..	140 lb. rock phosphate ..	140 lb. rock phosphate.
13	70 lb. rock phosphate	70 lb. rock phosphate	70 lb. rock phosphate.
14	200 lb bonedust	100 lb. bonedust	100 lb. bonedust.
15	100 lb. bonedust	50 lb. bonedust	50 lb. bonedust.
16	100 lb. superphosphate ... Spring dressing— 60 lb. sulphate of ammonia 30 ,, sulphate of potash ..	50 lb. superphosphate .. .. Spring dressing— 60 lb. sulphate of ammonia 30 ,, sulphate of potash ...	50 lb. superphosphate. Spring dressing— 35 lb. sulphate of ammonia. 20 lb. sulphate of potash.
17	50 lb. superphosphate ... . Spring dressing— 60 lb. sulphate of ammonia 30 ,, sulphate of potash ..	25 lb. superphosphate ... ... Spring dressing— 60 lb. sulphate of ammonia 30 ,, sulphate of potash ...	25 lb. superphosphate. Spring dressing— 35 lb. sulphate of ammonia. 30 lb. sulphate of potash.
18	100 lb. superphosphate ... ... Spring dressing— 30 lb. sulphate of potash 100 ,, dried blood	50 lb. superphosphate ... Spring dressing— 30 lb. sulphate of potash ... 100 ,, dried blood	50 lb. superphosphate. Spring dressing— 20 lb. sulphate of potash. 60 ,, dried blood.

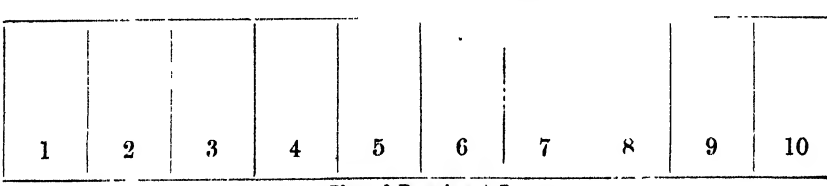


Plan of Experiment C.

Paddock No. 17. Plots, 10 chains x ⅛ chain; area of plots, calculated, 1/10 acre.

Manures applied to Experiment C, at per acre.

Plot No. 1	No manure.
2	2 cwt. superphosphate No. 1.
3	1 cwt. sulphate of ammonia.
4	½ cwt. sulphate of potash.
5	2 cwt. superphosphate No. 1. 1 cwt. sulphate of ammonia. ½ cwt. sulphate of potash.
6	1 cwt. superphosphate No. 1. ½ cwt. sulphate of ammonia. ¼ cwt. sulphate of potash.
7	2 cwt. superphosphate No. 1. 1 cwt. sulphate of ammonia.
8	2 cwt. superphosphate No. 1. ½ cwt. sulphate of potash.
9	1 cwt. sulphate of ammonia. ½ cwt. sulphate of potash.
10	No manure.

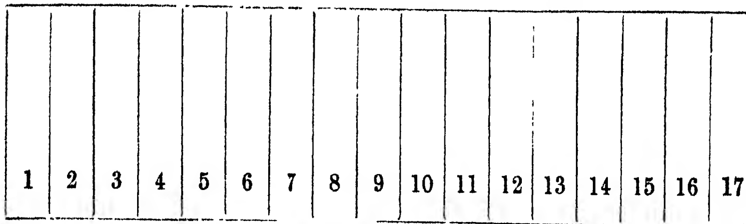


Plan of Experiment D.

Paddock No. 7. Area of each plot, ·063 acres.

Manures applied to Experiment D, at per acre.

Plot No. 1	No manure.
2	1 cwt. superphosphate No. 1.
3	½ cwt. sulphate of ammonia.
4	¼ cwt. sulphate of potash.
5	No manure.
6	1 cwt. superphosphate No. 1. ½ cwt. sulphate of ammonia. ¼ cwt. sulphate of potash.
7	1 cwt. superphosphate No. 1. ½ cwt. sulphate of ammonia.
8	1 cwt. superphosphate No. 1. ¼ cwt. sulphate of potash.
9	½ cwt. sulphate of ammonia. ¼ cwt. sulphate of potash.
10	No manure.



Plan of Experiment E.
Paddock No. 6. Area of each plot, $\frac{1}{16}$ acre.

MANURES applied to Experiment E, at per acre.

Plot No. 1	No manure.
2	2 cwt. superphosphate No. 1.
3	1 cwt. superphosphate No. 1.
4	2 cwt. A phosphate.
5	1 cwt. A phosphate.
6	2 cwt. Thomas' phosphate.
7	1 cwt. Thomas' phosphate.
8	2 cwt. superphosphate No. 1. 1 cwt. sulphate of ammonia.
9	2 cwt. superphosphate. ½ cwt. sulphate of ammonia. 32 lb. sulphate of potash.
10	1 cwt. sulphate of ammonia.
11	64 lb. sulphate of potash.
12	1 cwt. sulphate of ammonia. 64 lb. sulphate of potash.
13	1 cwt. superphosphate No. 1. 64 lb. sulphate of potash.
14	320 lb. No. 2 manure.
15	320 lb. No. 3 manure.
16	4 cwt. Thomas' phosphate.
17	No manure.

TABLE 1.—To test the requirements of the soil for different kinds of plant food.

No. of Plot.	Manure.	Experiment A.					Experiment B.					Experiment C.		Experiment D.
		1902.	1903.	1904.	1905.	Average yield.	1903.	1904.	1905.	Average yield.	Mean of un-manured	1903.	Mean of un-manured	Mean of 1904 and 1905.
		bh lb.	bh lb	bh lb	bh lb.	bh. lb.	bh lb	bh lb	bh lb	bh. lb.	bh lb.	bh. lb	bh. lb.	bh. lb.
1	No manure	14 17	35 20	18 27	17 25	21 22	30 57	25 33	21 8	25 52		35 20		24 36
2	Sulphate of ammonia	16 43	35 33	18 56	17 24	22 10	30 34	26 34	21 31	26 13		35 20		22 48
3	Superphosphate	19 30	33 6	18 9	18 25	23 32	35 42	25 46	25 22	28 56		41 21		21 5
4	Sulphate of potash ..	16 16	35 46	18 6	17 15	21 50	28 25	24 54	22 6	25 8		35 40		25 47
5	Superphosphate and sulphate of ammonia	20 6	39 26	19 39	19 11	24 35	34 7	29 16	24 48	29 23		34 20		24 55
6	Sulphate of ammonia and sulphate of potash	17 31	36 3	21 19	18 33	23 21	26 24	26 10	21 57	24 50	25 31	33 20	35 0	25 23
7	Superphosphate and sulphate of potash . .	19 18	39 26	19 7	19 0	24 12	32 48	27 1	26 37	28 48		36 48		25 19
8	Sulphate of ammonia, superphosphate, and sulphate of potash	16 0	38 36	19 43	17 21	22 55	31 21	25 43	22 51	26 38		36 40		25 7
—	No manure	...	..	...	.	.....	27 16	26 0	22 17	25 11		34 40		......

TABLE 1—*continued.*

No. of Plot.	Manure.	Mean yields of A, B, C and D.	Compared with Unmanured.
		bus. lb	
1	No manure	26 37	... .
2	Sulphate of ammonia	26 37	....
3	Superphosphate	28 43	+ 2 bus. 6 lb.
4	Sulphate of potash	27 6	+ 0 „ 29 „
5	Superphosphate and sulphate of ammonia	28 18	+ 1 „ 41 „
6	Sulphate of ammonia and sulphate of potash	26 43	+ 0 „ 6 „
7	Superphosphate and sulphate of potash	28 44	+ 2 „ 7 „
8	Sulphate of ammonia, superphosphate, and sulphate of potash	27 50	+ 1 „ 13 „

TABLE 2.—Results of Manures in good seasons.

No. of Plot	Manure.	Experiment A.	Experiment B.	Experiment C.	Mean Yield.	Compared with Unmanured.
		1903.	1903.	1903.		
		bus. lb.	bus. lb.	bus. lb.	bus. lb.	
1	No manure	35 20	29 6	35 0	33 8	
2	Sulphate of ammonia .	35 33	30 34	35 20	33 49	+ 0 bus. 41 lb.
3	Superphosphate	38 6	35 42	41 21	38 23	+ 5 „ 15 „
4	Sulphate of potash . ..	35 46	28 25	35 40	33 17	+ 0 „ 9 „
5	Sulphate of ammonia and superphosphate	39 26	34 7	34 20	35 57	+ 2 „ 49 „
6	Sulphate of ammonia and sulphate of potash	36 3	26 24	33 20	31 55	− 1 „ 13 „
7	Superphosphate and sulphate of potash .	39 26	32 48	36 40	36 18	+ 3 „ 10 „
8	Superphosphate, sulphate of ammonia, and sulphate of potash	38 36	31 21	36 40	35 32	+ 2 „ 24 „

NOTE.—Results of Experiment A were due to application of manures in 1902.

TABLE 3.—Results of Manures in dry seasons.

No. of Plot.	Manure.	Experiment A.	Experiment B.		Experiment D.	Experiment E.	Mean yields.	Compared with Unmanured.
		1902.	1904.	1905.	1904–5.	1902.		
		bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	
1	No manure	14 17	25 33	21 8	24 36	4 32	18 0	....
2	Sulphate of ammonia .	16 43	26 34	21 31	22 48	5 20	18 35	+ 0 bus. 35 lb.
3	Superphosphate	19 30	25 46	25 22	21 5	4 56	19 19	+ 1 „ 19 „
4	Sulphate of potash	16 16	24 54	22 6	25 47	6 24	19 5	+ 1 „ 5 „
5	Sulphate of ammonia and superphosphate .	20 6	29 16	24 48	24 55	5 44	20 57	+ 2 „ 57 „
6	Sulphate of ammonia and sulphate of potash	17 31	26 10	21 57	25 23	5 28	19 17	+ 1 „ 17 „
7	Superphosphate and sulphate of potash . .	19 18	27 1	26 37	25 19	5 44	20 47	+ 2 „ 47 „
8	Superphosphate, sulphate of ammonia, and sulphate of potash	16 0	25 43	22 51	25 7	5 44	19 5	+ 1 „ 5 „

TABLE 4.—To test lasting effects of Manures.

No. of Plot.	Manure.	Experiment A								Average yield for four years.	Total excess in four years.
		1902	1903.	1904.	1905.	Excess 1902.	Excess 1903.	Excess 1904.	Excess 1905.		
		bus. lb.	bus. lb.	bus. lb.	bus. lb	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.
1	No manure . ..	14 17	35 20	18 27	17 25	..		..		21 22	...
2	Sulphate of ammonia..	16 43	35 33	18 56	17 28	+2 26	+0 13	+0 29	+0 3	22 10	+ 3 11
3	Superphosphate	19 30	38 6	18 9	18 25	+5 13	+2 46	−0 18	+1 0	23 32	+ 8 41
4	Sulphate of potash .	16 16	35 46	18 6	17 15	+1 59	+0 26	−0 21	−0 10	21 50	+ 1 54
5	Sulphate of ammonia and superphosphate	20 6	39 26	19 39	19 11	+5 49	+4 6	+1 12	+1 46	24 35	+12 53
6	Sulphate of ammonia and sulphate of potash	17 31	36 3	21 19	18 33	+3 14	+0 43	+2 52	+1 8	23 21	+ 7 57
7	Superphosphate and sulphate of potash ..	19 18	39 26	19 7	19 0	+5 1	+4 6	+0 40	+1 35	24 12	+11 22
8	Superphosphate, sulphate of ammonia, and sulphate of potash	16 0	38 36	19 43	17 21	+1 43	+3 16	+1 16	−0 4	22 55	+ 6 11

NOTE.—During the season 1904, the plots manured with superphosphate were consistently earlier than the plots without, and ripened first.

TABLE 5.—Experiment A—Block 4.

No. of Plot.	Manure per Acre.	1902.	1903.	1904.	1905.	Average.
		bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.
25	140 lb. Pacific Island rock phosphate per acre ...	10 35	35 20	16 39	16 35	19 47
26	70 lb. Pacific Island rock phosphate per acre ...	11 5	31 35	17 40	13 17	18 26
27	300 lb. Thomas' Phosphate and 50 lb. superphosphate applied as top-dressing, in spring, 1902	12 27	37 55	19 4	20 0	22 21
28	300 lb. Thomas' Phosphate, with top-dressing, 1902, of 50 lb. superphosphate, 35 lb. sulphate of ammonia, and 30 lb. sulphate of potash ...	10 35	36 5	18 9	16 30	20 19
29	300 lb. superphosphate, with top-dressing, in 1902, of 60 lb. sulphate of ammonia, and 30 lb. sulphate of potash	8 37	28 0	18 9	16 5	17 42
30	300 lb. superphosphate, with top-dressing, in 1902, of 100 lb. dried blood, and 30 lb. sulphate of potash	11 25	33 25	16 39	14 42	19
31	300 lb. bonedust	10 57	33 0	16 24	13 45	18 31
32	200 lb. bonedust	8 25	34 5	13 36	11 35	16 56

NOTE.—The averages were taken of only sixteen plots, two of each. Only one application of manures was given, in 1902.

It will be seen, by reference to Table 1, that the best results were obtained from the application of superphosphate. This has been strikingly apparent throughout the whole of the experiments. The fact that the applications of superphosphate and sulphate of potash together have given an excess of 1 lb. over the superphosphate alone is not sufficient evidence in favour of the potash, as the margin is too small, and the practically negative results of the potash when applied alone would lead to the inference that the excess was due to the superphosphate.

The excess due to superphosphate throughout these years, one of which only was a good season, the other three being dry, does not, from a financial aspect, warrant the outlay.

The average application per year was 163 lb. per acre, which, inclusive of freight, would cost 6s. 11d. The excess yield of 2 bus. 6 lb. at 3s. per bushel would only amount to 6s. 3½d. All other applications resulted in a distinct loss, especially the expensive dressings of complete manures.

The application of sulphate of potash has given a slight increase, but in no way commensurate with the outlay. The result also has not been consistent throughout the experiment. It is reasonable to infer that the granitic soils upon which the crops were grown contain suitable quantities of available potash for the growth of good crops of wheat. This is apparent from the excellent results in many instances from the application of superphosphate alone.

As regards the application of nitrogen in the form of sulphate of ammonia, it is remarkable how consistently it fails to give results. This lack of response to nitrogenous manuring upon the part of Australian wheat soils has been pointed out by Mr. F. B. Guthrie in Vol. 17, page 295, of the *Agricultural Gazette.*

In Table 1, Experiment C, it will be noticed that 41⅓ bushels were obtained by the application of superphosphate alone, and that the application of sulphate of ammonia had no effect. It is clear that the soil had secured sufficient nitrogen from other sources to produce such a satisfactory crop, and it is interesting to know that the land had been bare-fallowed the previous summer. Also that the preceding season was one of drought, and that no leaching of nitrates could have taken place. The bare-fallowing also had favoured nitrification by the conservation of moisture and improvement of soil texture. It is reasonable to suppose that in wetter seasons some nitrates would be leached from the soil, and the desirable texture in some measure destroyed.

As regards the action of complete fertilisers, they have proved disappointing, and it is difficult to explain at the present stage of the experiments.

One fact must not be lost sight of, and that is—it is not difficult to overfeed the wheat plant under Australian conditions, and any application of manures which would lead to the over stimulation of the plant in its early stages may prove disastrous during seasons of insufficient moisture.

The richest lands are not the best wheat lands, and virgin soils frequently give best results for wheats the second or third year. The manuring of such lands whilst new will obviously be injurious rather than beneficial. The test applied in wheat culture is the number of bushels of grain per acre, but such is no criterion of the amount of plant-food a soil may contain.

There is obviously a condition of fertility for wheat culture to be aimed at which may under certain conditions be exceeded to the detriment of the yield. This optimum condition of fertility would vary in districts having different degrees of moisture throughout the wheat season.

As regards the consistent increases from the application of phosphoric acid in the form of superphosphate, it is reasonable to infer that the soils do not possess sufficient available phosphoric acid. Such applications have a very marked effect even in the very early stages of development, and induce early maturity. In many instances throughout the experiments the plots thus manured matured from five to seven days earlier than the unmanured. This fact alone, under certain conditions, may account for increased yields; the conditions being a dry summer and insufficient soil moisture.

It is most important to find out the most desirable quantities of this manure to apply annually, as it is not difficult to apply it in excess, especially in dry seasons. The evidence available points in the direction that comparatively light applications are desirable in the continuous cropping with wheat.

I would point out that in Experiments A and B, wheat was grown continuously throughout the experiments. Such is not a desirable practice, as a rotation of crops is preferable. The question of the manuring for wheat in connection with crop rotations would present very different aspects, and a discussion of such must be held over for a future article.

It will be seen in Table 2 that the effects of manures in a good season are much more pronounced and were attended in the case of the application of superphosphate with very profitable results.

This is most marked in Experiment C. As the results given for A are due to an application in 1902, and such has tended to reduce the mean excess over unmanured.

It will be seen by reference to Table 3 that the applications were not profitable; I am of the opinion that many of them were excessive for such seasons. The low yields were due to the lack of moisture, and not plant-food. It is interesting to note that in the driest year, viz., 1902, the yields from the manured plots were not reduced below those of the unmanured.

Table 4 is interesting in that it shows the lasting effects of manures, and that, if a dry season follows its application, results will be obtained in subsequent years. The results in several instances in this table are substantial and profitable. The total excess in four years in the case of superphosphate and sulphate of ammonia was, 12 bus. 53 lb., this being the highest This increase at 3s. per bushel would be £1 18s. 7d., whilst the cost of manures inclusive of freight would be £1 0s. 2d., leaving a profit of 18s. 5d. per acre. It will be seen that the manures became largely appropriated in the good season of 1903.

In 1904 and 1905 the sulphate of ammonia and superphosphate combined gave a consistent increase. Also sulphate of ammonia combined with sulphate of potash gave good results during these years. These results will not be lost sight of, and may prove valuable in conjunction with future experiments.

It is also interesting to note that the plots which had received dressings of superphosphate in 1902 were earlier than the others, both in 1904 and 1905, the third and fourth years after application.

In Table 5, the heavy dressing of Thomas' phosphate and spring dressing of superphosphate alone has given consistent increases throughout the four years, and is interesting when compared with the light dressing of 70 lb. of rock phosphate: the heavy dressing giving an increase in four years of 15 bus. 40 lb. over the plots dressed with the 70 lb. of rock phosphate.

From the above it may be concluded :—

That the soils at this farm require phosphoric acid, and that superphosphate can be profitably applied.

That such applications are more profitable in good seasons.

That when applied in dry seasons or seasons of insufficient moisture to render the plant-food available the manures remain available for succeeding crops, and ultimately are remunerative.

That applications of nitrogen under the above conditions generally seem superfluous.

That the same applies to the application of potash.

That there is some evidence to show that a small percentage of nitrogen and potash in conjunction with phosphoric acid would be beneficial.

In the light of the foregoing I would recommend as a profitable application for similar soils of the district a manure containing approximately 15 to 17 per cent. water-soluble phosphoric acid, 1 to 2 per cent. of nitrogen, and sulphate of potash equal to 1 per cent. of pure potash. To be applied generally at the rate of 1 cwt. per acre.

I would also point out the necessity of taking efficient steps to conserve as much moisture as possible in the soil, as such manures cannot be rendered available without the necessary amount of soil moisture. This moisture is more effectively conserved by good tillage, and the adding to the soils which lack humus some vegetable matter in the form of crop residues. Such is attained by a system of rotation of crops, which is made profitable by a judicious mixture of sheep and wheat.

An Obscure Disease Affecting Wheat.

Mr. W. W. Froggatt, Government Entomologist, reports, under date October 10th:—

Acting on the report from Cowra that there was an obscure disease in the wheat fields of that district, I investigated the matter last week.

I visited Iandra Station, thence across to Moorila, and back, *viâ* Young; but, in consequence of the continuous wet weather, was unable to get into the paddocks as much as I should otherwise have done had the weather been fine.

Mr. Murray, manager of Iandra, went round with me, and informed me that at first there were many small white worms on the roots of the dying wheat in the infested areas. These we soon found, but on close examination they have proved to be the young of earth worms, and are only feeding on the damaged tissue, and are not the cause of the disease. I, however, thought I could detect other thread-worms under the basal leaf-stalk, and on careful examination in the laboratory find a great number of neomatode worms in the damaged tissue of the stem just above the roots. The stems and flag of each wheat-plant are also much infested with fungi and rust, but this is probably only a secondary state brought about by the decay set in from other causes. The thickened tissue of the dead roots would also be caused by neomatodes.

Patches of wheat both on high and low ground, in both old and freshly cultivated land, have failed to grow more than a few inches above the ground before dying back; some of the stunted plants under the constant rain have recovered enough to put out fresh rootlets, but the diseased patches are very noticeable among the healthy wheat. Some of the wheat-growers put it down to the manures used, but it is just as common on the land where no manures have been used. Mr. Murray considers that it is worst where the ploughing on fallow land has been shallow and a quantity of herbage has been only lightly covered. This may have helped the development of the disease, but is not the cause. If the damage is caused by neomatode worms it is a very serious thing and very difficult to cope with. Clover and oats are very much subject to neomatode infestation, but it is uncommon in wheat. Last year the onion crop in the south-east of Victoria was almost a complete failure on account of the onion eel-worm. Eel-worms or neomatodes can be introduced into new country very easily with horse feed, stable manures, or diseased plants, and when the conditions for their growth are suitable they can multiply so rapidly that the land becomes "sick."

In the case of oat and clover stubble in Europe being infested, the farmers before ploughing give the land a dressing of quicklime, salt, or kainit. Rotation of crops is the most effective.

Of course this present disease may not be caused by the eel-worms, though there is no doubt they exist in the plants. I would advise that if any new developments turn up we are informed at once. Next season the infested land of this season should be carefully watched, and as soon as the wheat is above the ground investigations should be carried on.

Farmers' Fowls.

[Continued from page 937.]

G. BRADSHAW.

CHAPTER XL (*continued*).

AFTER houses come the coops, setting-boxes, &c., the latter, on the duly recognised prize poultry farms, being quite a feature. The farmer, however, requires very few or none of these. The farm-yards and out-buildings afford so many secluded corners that quite a number of broody hens can be suitably accommodated for their three weeks' retirement without one penny outlay. However, when the chickens arrive, the question of accommodation arises, and whether a free range or confinement for the hen and brood is best, there is no disputing the fact that the first three or four weeks are the most important in a chicken's life; and despite the fact that the free range in the farm-yards, with its multifarious weeds, seeds, and insects, affords an ideal chicken existence, the advantages of such will be of more consequence after the above age. There are still some who consider that, where circumstances allow, the hen and chickens should have entire liberty from the day of hatching. This system I can absolutely condemn. There are certainly some hens that are most careful, and know that for a time their chicks require much brooding, heat, and rest, but others, if given their liberty, run the chickens off their legs, frequently resulting in many losses; indeed, the bulk of practical poultry-breeders are now satisfied that to rear a brood successfully it is necessary that the hen be cooped up for three or four weeks, the chickens of course to have liberty. They will, however, up to this age not wander too far, while for the first week or two the sense of confinement, and having little scope for exercise, encourages the hen to brood the chickens more frequently, and thus impart heat to them—that great essential to young life. Absolute confinement is, however, neither advocated nor yet necessary; indeed, after the first three or four days the hen and chickens should be allowed, say, half-an-hour or more liberty for dusting, which is actually the fowl's bath, instinct thus prompting them to this means of ridding themselves of that bane of all living animals—vermin. I have mentioned a half-hour's exercise; this should not be extended, otherwise, when re-cooped, the hen becomes fretful, pines for liberty, and will not brood the chickens in her former way.

The above are, perhaps, reasons enough to show that, for success in rearing, it will be best to coop the hen. The next consideration being the sort of coop, here again the advantages of the farm are apparent.

In or about almost every holding there are old cases, boxes, and other grocers' empties, which the farmer can, with a hammer and a few nails, make adaptable to the most extensive requirements. No wooden floor is required, the earth being best, the front of box taken out and a few laths substituted, with a space of from 2 to 3 inches between each to allow the chickens to come out and in. The coop should, in the interest of cleanliness, be moved a short distance each day, and which also

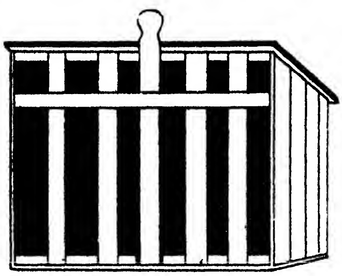
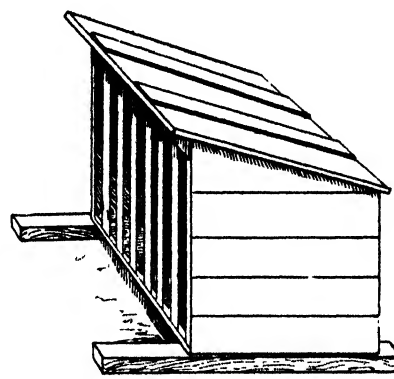
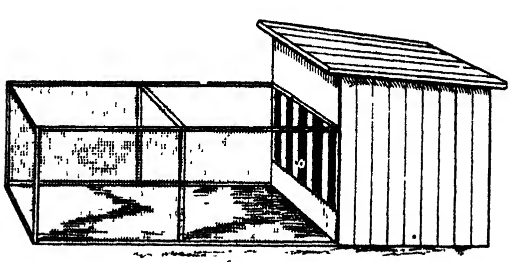


Fig. 1.



warrants the chickens venturing on to fresh ground in their wanderings. After four or five weeks' cooping the hen and chickens can be given full liberty.

Just as with poultry houses, some farmers may prefer appearance, and are prepared to spend a few shillings on more modern constructions than those mentioned. To those who do, there are quite a large number of



designs to select from; but, personally, I have found that illustrated Fig. 1 is the most easily and cheaply built, neat and adaptable in every way to the requirements. The coop is 2 feet square, made of ½-inch tongued and grooved lining boards, 8 feet of inch square stuff for cornering, and a few laths for front. The wood for the complete coop will cost under 2s., and can be built in a short time. Two of this construction I have had in use for the past eight years are still sound. Some of the other coops

illustrated will commend themselves for inexpensiveness, while those who desire neatness in their poultry outfit can make a selection from the illustrations submitted.

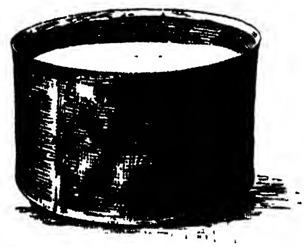
Following coops come drinking vessels. The latter in poultry supply houses are quite a feature, made of either iron or crockery, and of many designs. For the poultry fancier or other breeder whose taste is for neatness, and has a lengthy purse, there are a multitude to select from. The ordinary

Herring tin.

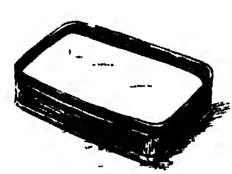
Small meat tin.

Drinking Vessels for Chickens.

farmer, however, requires none of these. The usual kitchen empties afford designs adaptable to every stage of poultry-rearing, from the newly-hatched chicken to the adult fowl. There are a small number of poultry-breeders who adopt a system of withholding drinking water from the chickens for a period of from one week to several. The fact, however, remains that immediately after chickens have their first feed, whether it be dry meals, broken grain, or moistened soft food, if water is available they drink, and it must be admitted that at this stage of life drinking is neither an acquired habit or taste, but a prompting of instinct, and realising this the wise poultry



Large meat tin



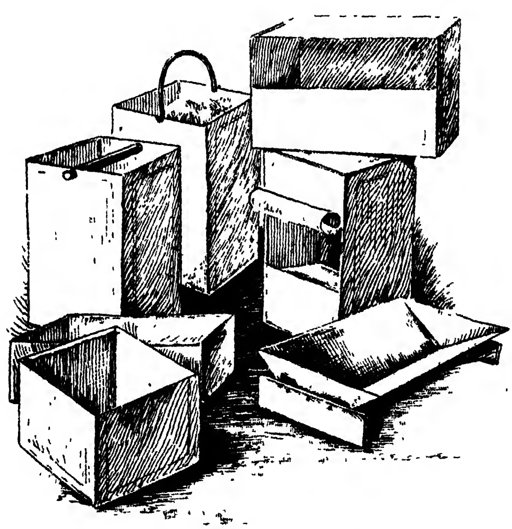
Sardine tin.

Drinking Vessels for Chickens.

breeder will place drinking water before the brood at all times, and in suitable vessels; by suitable I mean those easy of access, and not too deep, otherwise the chicks may get into it and receive a chill, if nothing more serious. To meet chickenhood requirements in this respect, I have found nothing equal to the ordinary sardine tin, what is known as halves being the most suitable. These are quite flat, which prevents them being capsized, and should the chickens trample into them, the water is so shallow as to have

no ill effects. When the brood gets two or three weeks old a larger bulk of water will be necessary, the round or oblong herring tin becoming the more suitable; later on larger vessels will be required, and such can be had in abundance about any farm-house or other dwelling. The 2-lb. meat tin, the fruit can cut down, and a host of others are all equally adaptable, and the cost nil. For a water vessel for adult fowls the kerosene tin is *par excellence.* This article, as will be seen by the illustrations, can be cut into a variety of forms, and all as suitable as the most expensive water fountains, whether of American or other designs.

The kerosene tin, unlike the others, is not altogether a waste article, still its plentifulness is such that even when it has to be purchased the price is from 2d. to 3d. each, being about one-quarter its original value, and there is not a doubt were it three or four times the present price it would still continue the most universally used vessel on the poultry farm—for in addition to the above, with the ordinary wire or old bucket handle it is used for conveying water to the fowl-yards, for heating water for mixing the morning foods, for cooking the waste vegetables, meat scraps, &c., for carrying the food to the various runs or yards, and as a vessel used in cleaning out the poultry houses. With one side taken off it can be used for mixing the food for from thirty to forty fowls. Taken altogether, as has been shown, poultry houses and coops on the farm cost but a trifle, while the other requirements



The Kerosene Tin in the Poultry Yard.

in the way of appliances are as a rule to be found in the scrap heap. This further shows the advantages the farmer has for keeping fowls over those who have first to debit the undertaking with a large outlay for houses, runs, appliances, labour, and rent, and if the latter make the business pay, how

much more so should the farmer whose labour is in his own family, who has no rent to pay for this side issue, and in the matter of food, not a day in the year passes but something is available from the land, for which the ordinary poultry-farmer has to pay, all of which emphasises the contention that with good available metropolitan markets for live poultry and eggs the one class of the community who should do well is the farmer, or other landholder of the State; and realising the many facilities and advantages in their favour, should these people not in the near future very materially increase their now limited output of this article, there is just one, and, perhaps, a wholesome conclusion—they are too well off to bother about fowls.

CHAPTER XLI.

Feeding, &c.

OF the numerous issues in connection with profitable poultry-keeping, none of late years has received so much attention as aliment. This cannot be wondered at, seeing that the difference between the cost of what a fowl eats and what its carcase or eggs realise is the chief end of all poultry-keeping, and termed profit; and how to reduce the cost of keeping a hen, and thus increase her profitableness, continues to afford a big field for scientific investigation. In the forefront of these are the numerous American experiments, where most exhaustive tests have been made with every known food available in that country, and despite the fact that the conclusions are not all unanimous, there is the satisfactory declaration from all that the ordinary cereal foods obtainable or grown on a farm, and which have been used for ages as fowls' food, cannot be superseded either for cheapness or profitable results. It is to these American stations that we of late have heard so much of the wide, the narrow, and the balanced ration, the proportion of the nutritive elements in the various grains or other foodstuffs, and the lengthy scientific articles on the subject which appear in the American poultry journals, and frequently copied here, and which appeal to the medical fraternity, the analyst, the scientists, and teachers and students of chemistry, and others who understand them, the articles are valuable in the extreme; but to the ordinary Australian poultry man or fancier whose first lesson in chemistry is long since forgotton, the bulk of the science of feeding articles are so much waste.

There is no desire here to discount in the remotest degree the value of the investigator, but when in a one-inch space of an ostensible utility poultry journal, we find the following, it will be conceded that such terms are neither appreciated nor applicable to Australian poultry-farms:—"bile," "calories," "carbon dioxid," "maltose," "zylose," "scrum albumin," "petone," "asparagin," "gliadin," "pentosans," &c., and numberless other as obscure terms are given as necessary knowledge in the feeding of fowls.

The fact, however, remains, that the strenuous life of the poultry-farmer in his efforts to make a living from his fowls has neither time nor desire to master all that is involved in the above terms, particularly as he has had overwhelming evidence that the best results ever obtained in any country from fowls have been in this State by the simple bran, pollard, and wheat judiciously supplied. Less than three months ago I had a call from a gentleman who could discourse on the chemical elements of nutrition for poultry in the most scientific language, yet he wanted to know how it was his birds did not lay. On inquiry I learnt from him that the fowls were at his place when he purchased it three and a half years prior to his visit, and he did not know what age they were at that time, and was unaware that feed was of the smallest consideration so far as his stock was concerned, the bulk of the birds having laid all the eggs they ever would lay, irrespective of scientific compounds.

The fact obtaining that a number of young hens of any breed of, say, from 6 to 9 months old, if turned into the primitive bush will find weeds, seeds, and insects, which will not only sustain life but will also be sufficient to furnish a moderate egg supply, while the same number of aged hens if kept under the most sanitary conditions in regard to housing, and fed on the approved balance ration for laying, will produce but very few, for the simple reason that their ovaries are exhausted, and they have no more eggs to lay. However, irrespective of what is said above, there are a few simple scientific facts in connection with food and feeding from which the poultry or other farmer can derive much benefit, and which is given herewith in the simplest form possible. At the same time, whether the salient points of such be committed to memory and the feeding of a flock of fowls be formulated from it, the fact obtains and will remain that in order to get the best results in the way of a generous egg supply, the first consideration will be young healthy fowls of almost any of the now popular breeds. The next and chief of all essentials being that they should be of a good laying strain or family, this having been conclusively proved at every laying test held throughout Australia, the last Hawkesbury and Rockdale competitions being noteworthy instances. At the last College test one pen of six white Leghorns laid 1,411 eggs, or just on 234 for each hen; while at the same test another pen of this breed, housed, fed, and managed exactly the same, produced but 635 eggs, considerably less than half the above. One pen of Silver Wyandottes laid 1,303 in the twelve months, and another pen but 820 eggs. At the Rockdale competition a pen of Black Orpingtons finished at top with 1,461 eggs, being over 243 for each hen; another pen finished in the lowest place with but 928. Scores of like instances could be quoted, all showing that neither breed nor yet feed was responsible for the extraordinary difference of production, family prolificness or strain being the important feature, consequently, although a table of food values are given, the poultry man who mixed his foods on the most perfectly balanced ration, whether for egg production or carcase, might find this a more expensive system than the usual morning meal of bran and pollard, and the cereal most available for the evening food.

We all know that the object of feeding is to provide material to sustain heat, growth, development, energy, and to supply the essentials for the formation of eggs. When more food is given and consumed than meets the above requirements, the surplus goes to fat, and is stored as a reserve, and if conditions be such that this storage does not take place, then the excess food is lost; and to prevent this loss, and a proper utilisation of the food, a few chemical facts may be stated.

The following table gives the classified component parts of foods, and shows how each is made up, and the functions, together with the percentage of each for a properly balanced ration, considered sufficient for health without reserves:—

Appellation.	Constituents.	Functions.	Proportion in every 100 parts for a normal ration.
1. Albuminoids or proteids.	Nitrogen, oxygen, hydrogen, and carbon.	Flesh, blood, tissue, bone, and egg formers.	13·5
2. Fats or oils ..	Carbon	Fat formers (both for body and egg) and heat producers.	5·2
3. Carbo-hydrates ..	Carbon, hydrogen, and oxygen (in the form of starch, sugar, and gum).	Heat producers	55·8
4. Ash	Salts and minerals, such as phosphorus, sulphur, lime, and alkaline salts.	Phosphorus and lime for bone and egg-shells; sulphur for feathers; salts for blood and digestive processes.	3·
5. Husk or fibre ..	... ..	Of little value . ..	9·
6. Water ..			13·5
			100

The albuminoids or proteins are a group of elements of which the white of an egg or lean meat will suffice for an example. Flesh, blood, feathers—in fact, the bulk of the fowl or animal is composed of this substance. Protein, while building up the animal, is also a heat producer when used in excess. The chief functions of fats are as heat-givers. Carbo-hydrates, milk, sugar, starch, are forms of this element, and produce heat and mechanical force; when there is an excess supplied it is stored as fat. Ash is the part of food left after burning. The supply of ash in most foods is sufficient for the needs of animals.

Nutritive ratios is the proportion of albuminoids or proteins to the carbo-hydrates, and the proper balancing of these nutrients is of much importance to all stock-keepers. In working out a dietary it is not necessary to take into account ash, husks, or water, and it simplifies matters to treat the fats

as carbo-hydrates. What are called feeding standards is the mixing of certain foods in the proportions necessary to produce particular needs, and in poultry there are three standards of requirements, namely, for growing stock, for fattening, and for producing eggs. There are four groups of nutritive substances essential to sustain life, protein, carbo-hydrates, fat, and minerals, and it is the arranging of these in proper proportions that constitute a feeding standard, and these standards have to be prepared for the different classes of work required of them; in other words, the food has to be arranged for the fowl's requirements, *i.e.*, egg production, growth, or fat. Further than this, the value of any food is in relation to its nutritive digestibility. In vegetables the nitrogenous elements are not present in so concentrated a form as in animal foods, and the non-nutritive elements of all foods are expelled. For the production of eggs and the laying on of flesh the same class of constitutents, the albuminoids or protein, are required. In fattening it forms muscle and lean meat, and in the laying fowls it produces albumen or the white of eggs.

In egg-production protein is a very important factor, seeing that an egg contains 13 or 14 per cent. of protein, hence it will be necessary to provide this feeding element when eggs are the object, the best balanced ration for this object being one part of protein to four or five parts of the other constitutents. This protein is to be had in the most available and cheapest form in lean beef. In a natural state the worms, grasshoppers, and other insects provide this protein. All the cereal foods supplied to fowls contain the same constitutents, the difference between them being that some have a greater proportion of flesh-forming materials—protein—than others. Some excel in heat-producing properties—carbo-hydrates—maize and buckwheat being examples. Should protein be in great excess, fowls suffer in health; while if the carbo-hydrates are fed too much, fat is produced, and egg production suffers. This brings me to the analysis of grains and other foods, but unfortunately we have here to fall back upon the analysis made in England or other countries, where the climatic conditions are so different from here as to very largely affect the accuracy of these for the conditions here. Take that most popular of all cereals, wheat. The English analyses of a large number of wheats show it to contain 14 per cent. of water, while in tests made on samples grown in our dry climate, the moisture element was but 10, and it is quite conceivable that a like variation would occur in all our cereals.

As an assistance to formulate a diet for the various requirements of fowls, it may be stated that for growing stock a ratio of 1 : 3·54 is considered best, that is, one part of protein to three and a half of the other elements. For fattening stock 1 : 5·6, and for laying stock 1 : 4·55 are given as the correct ratio. Lewis Wright in his great poultry work gives a table of food values, and is often quoted. This, however, is not now much used as the basis of a dietary, the following, the result of more exhaustive experiments, being now more generally adopted:—

TABLE showing the constituent parts in every 100 of the principal Foods suitable for Poultry, with their nutritive ratio.

Foods.	Albuminoids or Flesh-formers.	Fats or Oils × $2\frac{1}{4}$ = Value in Carbo-hydrates.		Carbohydrates or Heat-givers.	Ash (Salts and Minerals).	Husk or Fibre.	Water.	Ratio.
Approximate proportion of a normal ration	13·5	5·2	=11·7	55·8	3·	9·	13·5	1 : 5
Oats	13·	6·	=13·5	54·	3·	10·	14·	1 : $5\frac{1}{2}$
Wheat	12·	2·	= 4·5	69·3	1·7	2·5	12·5	1 : $6\frac{1}{7}$
Barley ..	10·	2·	= 4·5	58·	2·	14·	14·	1 : $6\frac{1}{4}$
Maize	10·	5·5	=12·4	66·	1·5	5·	12·	1 : $7\frac{4}{5}$
Buckwheat	9·	1·5	= 3·4	60·	2·	14·5	13·	1 : 7
Sunflower seed	13·	21·	=47·2	17·7	3·	37·3	8·	1 : 5
Linseed	20·5	35·5	=79·9	15·2	3·4	13·3	12·4	1 : $4\frac{3}{4}$
Rice ..	7·6	0·3	= 0·7	77·4	0·7	..	14·	1 : $10\frac{1}{4}$
Ground oats	15·	5·5	=12·4	48·	2·5	19·	10·	1 : 4
Oatmeal	15·	6·	=13·5	62·	2·	5·	10·	1 : 5
Bran ..	14·5	4·	= 9·	51·5	6·	10·	14·	1 : $4\frac{1}{7}$
Pollard .	15·	4·	= 9·	60·	4·5	3·5	14·	1 : $4\frac{3}{5}$
Barley meal	13·	2·	= 4·5	60·	2·	9·	14·	1 : 5
Bean and pea meal	25·5	1·5	= 3·4	45·	3·	11·	14·	1 : 2
Malt culms or sprouts	23·	1·8	= 4·	48·	6·8	10·	10·4	1 : $2\frac{1}{4}$
Brewers' grains	5·	0·4	= 0·9	9·4	1·2	7 6	76·4	1 : 2
Potatoes ...	2·2	0·0	= 0·0	20·3	0·9	0·6	75·	1 : 9
Clover hay	4·	0·8	= 1·8	11·4	2·	5·	76·8	1 : $3\frac{3}{10}$
Cabbage	2·4	0·4	= 0·9	3·8	1·4	1·5	90·5	1 : 2
Onions .	1·5	0·2	= 0·5	4·8	0·5	2·	91·	1 : $3\frac{1}{2}$
Lean meat	20·	3·	= 6·7	0·0	2·	0·0	75·	3 : 1
Green bone .	20·	26·	=58 4	0·0	24·	0·0	30·	1 : 3
Milk ...	4·	3·5	= 7·9	5·	0·7	0·0	86·8	1 : $3\frac{1}{5}$
Milk separated	3·9	0·4	= 0·9	4·5	0·0	0·0	91 2	1 : $1\frac{2}{5}$
Egg	14·	16·	=36·	0·0	1·1	0·0	68·9	1 : $2\frac{1}{3}$

The above has been compiled from several tables in order to arrive at a mean standard which would represent an average sample of fair quality.

The above references on the feeding subject from a scientific point of view are brief, but not unnecessarily so, seeing that were they given exhaustively to a degree they would be no more valued, for not one poultry man in a hundred would ever think of putting them into practice, and as mentioned before, were a diet formulated by either weight, measurement, or scientific value, other important essentials in poultry-breeding for profit might be overlooked, and the financial result disappointing. We all know maize is a very fattening food, its ratio being shown as 1 : $7\frac{4}{5}$; yet the farmer, say, in the Wellington district who is breeding some fowls for the table, and has a quantity of small broken wheat, would never think of sending the latter to the market to be sacrificed for a few shillings a sackful, and pay market rates and railage on maize from Sydney. The latter would fatten his fowls quicker than the light wheat, but not in proportion to the cost.

In the same way the farmers on the Northern Rivers, who have maize in abundance, irrespective of its fattening tendencies, is not going to pay freight on it to Sydney and purchase wheat in return for his laying hens.

The whole aspect of the food question is in relation to the cost. Certain grains, roots, or meat may make the most balanced ration in the world, but the cost may be such as to make them prohibitive for feeding fowls. An illustration will suffice. A most excellent diet for fattening cockerels for the market is maize-meal and potatoes. This food is the most largely used in Ireland, where they do an immense export poultry trade to England. The former, although grown here, is not cheaper than in Ireland; but coming to potatoes, in this country of countless acres and every variety of soils, temperatures, and other favourable conditions, we do not produce enough for our own needs, with the result that this product is two or three times dearer than in the Old Country, and for that reason an unprofitable commodity to feed our fowls.

The following summary of the properties of the various foods will be found useful, their use by the poultry-keeper depending solely on the price on which they can be locally obtained.

The requirements of fowls, as omnivorous birds, are—

Grain, ground or whole; herbage, cooked or raw; flesh in some shape or other; water; grit and lime.

Grain is given either as hard or soft food. The latter, being a departure from nature, needs some explanation. Feeding on hard grain under domestication must not be compared with what a fowl does in this direction in a wild state, when the food is picked up here and there. In such case, by the time hunger is appeased a great portion of the first-found seeds have been softened and passed on from the crop to the gizzard, and have reached the consistency of soft food, whereas under domestication the fowl usually receives its food at stated intervals and in bulk. The crop is more quickly filled. So that the grain may be more rapidly assimilated, it is expedient to give soft food, especially at certain seasons of the year, as a morning meal.

Soft food, mixed dry and crumbly, should always be given in the morning in winter, as the fowls are thereby better enabled to withstand the difference between the outside atmosphere and that of the sleeping-house. It is well to give the soft food warm in cold weather.

Hard grain should form the evening meal, because, being more slowly digested, it carries the fowls better through the long hours of night.

Herbage plays such an important part in a fowl's dietary that to neglect the supply of it is most culpable. Where there are grass runs, greenstuff is at hand, especially in summer; but fowls in confinement often suffer for the want of it. Lettuce, cabbage, mangolds, turnips, either cooked or raw, will be beneficial and relished.

Chaffed clover hay, scalded overnight and mixed with the soft food, is excellent for laying hens, and is capable of supplying part of the lime needed for egg-shells.

Flesh is secured by fowls at large in the shape of worms, insects, and grubs, but in confinement and during winter this is denied, and meat should be supplied in some form.

Water must be given regularly and often. The vessels containing it must be frequently cleaned, and should be kept out of the sun's rays. A great many ailments contracted by fowls are caused by polluted water.

Grit is an absolute necessity. When taken into the gizzard the powerful muscles of this organ use it as mill stones, consequently it should be hard and rough.

Lime must be provided, and may most conveniently be in the shape of old mortar or broken oyster shells. This is needed, as before mentioned, for bone formation and for the shell of the egg. Egg-shells, if well broken, may be mixed with the soft food, or put in the lime-box.

Oats have the best balanced ratio of all grains, but for poultry they must be white and heavy.

Wheat is a good food, but deficient in fats and excessive in starchy matter.

Bran and pollard are well-balanced foods, and most useful in poultry-feeding.

Barley is low in flesh and fat formers and excessive in fibrin.

Maize has been subject to much abuse as poultry food. It is somewhat low in flesh formers and high in fats (often more so than given in the foregoing table): it has also a high percentage of starchy matter, but it is extremely useful in balancing other foods and as an occasional food in winter for fowls at large.

(To be continued.)

Treatment and Care to Prevent Sourness in Wine.

M. BLUNNO.

MANY wine-growers and wine merchants are under the impression that one of the tests of the capability of an expert in viticulture and in œnology is whether he can through some remedy, or through the use of chemicals, succeed in repristinating the palatableness to wines that for one reason or other have turned sour, or otherwise unsound and disagreeable. I am aware that many *nostrums* and other patent ingredients are put on the market as wine restorers, wine correctives, to beguile the credulous wine-growers who think that a bad wine can be physicked into an excellent potation.

I say emphatically that a bad wine remains such, and the only thing an expert might do is to prevent the alteration, usuallv traceable to the action of micro-organisms, becoming worse. Rational systems of wine making and keeping are the only way to make good wines; knowledge and diligence should be brought to bear when making the wine, and while it is still sound. Anything at all done after the wine is spoiled is a loss of time. The most common of wine diseases in this State is sourness or acetic fermentation. Wines with an alcoholic strength under 30 per cent. proof spirit should never be left in ullage, specially in Australia, where so few cellars are built as cellars should be. The great majority are above ground, sheets of galvanised iron are their walls and roof, or pieces of bark held together, keeping the interior much cooler than the iron sheets, but yet very far indeed from the requisites of a real cellar. Very few have brick or mud walls, but even then they are generally above ground. Large doors and large windows are kept wide open or closed just as the chance may be without any thought as to regulating the temperature of the interior by taking advantage of the ventilation that can be made possible, by regulating the opening or closing of the windows and shutting off the sun by closing the blinds. Even by this simple means it would be possible to keep the cellar a little cooler, or at any rate as cool as its imperfect structure would allow. Their temperature in summer is hardly 4° or 5° Fahrenheit below that outside, and such places are capital for keeping wine which it is intended to transform into wine-vinegar. Such cellars would be unsuitable even to keep wine-vinegar, once it had reached the complete state of acetification. Vinegars, in fact, are kept in cooler sites to age and to mature. Were they kept in such hot-houses like some of the Australian cellars, even the vinegar would deteriorate. However, I am not going to deal with vinegar in this paper. In default of suitable cellars the wine-maker ought to be twice as diligent, and never allow any cask to remain in ullage. Weekly filling up of the casks is as indispensable a practice as is strong the desire of a person to succeed in his undertaking. Wine-makers should for this operation employ only the most trustworthy

employee in their cellar, if they cannot do it themselves. The proprietor or the manager should not be loath to make periodical inspections of the state of the casks, to see for himself whether his instructions are carried out. Apart from verifying the amount of diligence of his head cellarman, the proprietor or manager by being always on the alert would prevent the consequence of the fondness for wine of some of his workmen. No doubt a strong temptation is offered by a cask full, and a bit of syphon or a short length of reed or a slender tin tube, like a penny whistle, called a *flageolet* in French cellars. A petty theft of a pint of wine now and then might mean the loss of £100 to the owner, because while he thinks the cask is full, the vessel is in ullage all the time, and the surface of the liquid gradually turns sour—that is, acetification sets in.

In the atmosphere of a cellar, on its wall, on the floor, on the utensils inside and outside the casks, abound all the various micro-organisms of the different wine diseases. The most sound grapes carry on them some baleful germs that, if given favourable conditions for their multiplication, would spoil the wine. Thus in the soundest and best wines are always to be found a few of these micro-organisms in a latent state constituting a continual danger, and real harm may follow if care is not taken to prevent their development. We know that even in the healthiest man germs of various and dreadful diseases are deposited in the different parts of his body, and yet cause no harm as long as the general conditions of his health are satisfactory, and no special opportunity is afforded these insidious agents to increase in number and virulence.

You leave a cask of wine in ullage, and if the temperature of the cellar is anything about 70° Fahrenheit, you will give the *Diplococcus aceti* its chance to transform the surface layer of the wine into vinegar. The *Diplococcus aceti* is ærobic micro-organism—that is, it needs air to develop and multiply. It is the agent of the oxidisation of the alcohol, transforming it into acetic acid, thus—

$$C_2H_5OH + O = C_2H_4O + H_2O.$$

Ethyl alcohol and oxygen. Acetaldehyde and water.

$$C_2H_4O + O = C_2H_4O_2 + H_2O.$$

Acetaldehyde and oxygen. Acetic acid and water.

The acetification is gradual, and proceeds from the top layers of the wine downwards. The surface of the liquid is covered by a very thin brown film, iridescent; some of it adheres to the velins, and the wine looked at through a sampling glass is dull. This film is constituted by the colonies of the *Diplococcus aceti*. When the alteration is at its early stage, it is a good practice to remove with a syphon the top portion of the wine in that cask, until by continuously sampling the liquid running from the syphon it is certain that the sound layer is reached. The quantity so affected is kept separate and made into vinegar, while the former cask, from which several gallons have thus been removed, is put in one or more smaller casks or vessels. The former cask is then well washed with a solution of 5 per cent. of

caustic soda, this being followed by another solution of 5 per cent. sulphuric acid, and after that it is steamed, then rinsed twice with fresh water, dried, sulphured, making it thus fit to be used again.

It is the custom of cellarmen when taking a sample from the cask to hand over to the visitor the bung to smell, to convince him that the vessel has always been properly filled. A bung that has only a vinous smell and does not smell sour is a preliminary sign that the contents is also not sour. The wood used for making bungs should be of very close grain; porous wood is unfit for the purpose, as the wine will rise by capillarity, soak it through, and become sour; from the bung then the sourness is communicated to the top layer of the wine. For the same reason the shabby practice of some people who wrap the bung, when this is too small for the bung-hole, in two or three layers of cloth to make it fit is to be condemned. Bungs can be made absolutely impervious by dipping them in molten paraffin; the paraffin will close the pores of the wood and prevent the wine soaking into it. The bung fitting tight into the bung-hole hardly requires any other protection round it. However, it is the practice with some people to put some slaked lime round the bung, which would serve a double purpose, viz., prevent the acetification of wine rising by capillarity between the sides of the bung and that of the bung-hole, also to filter the air that will gradually get into the cask and take the place of the wine lost by evaporation through the pores of the staves and bottoms. Good as the idea may appear at first, it has all the same several inconveniences. First of all some of the air-slaked lime round the bung is apt to fall in the wine when removing the bung; secondly, although it acts as filter of the air, its oxygen gains access just the same, and I have already said that the *Diplococcus aceti* depends on it. A good bung of hard and close-grained wood, dipped first into paraffin, and well fitting into the bung-hole, is all that is required; although it would be well just to lay round the bung a thin layer of tallow to further block the interstice between the bung and bung-hole. Specially round the bung of the cask it should be absolutely clean; it is near the bung that wine is spilt when taking samples with the velins, so those few drops will soon go sour and become a substratum for a colony of *Diplococcus aceti.* When bungs become impregnated with sour wine the best thing to do is to keep them for half an hour in boiling water; after that treatment they are fit to be used again.

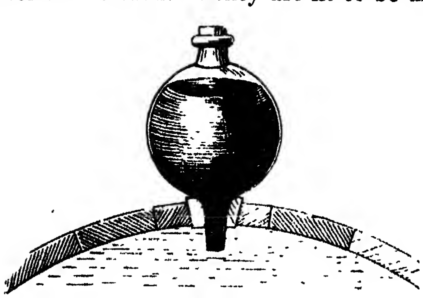


Fig. A.

In order to avoid the work connected with a weekly inspection of the cask to see whether it is full, an old arrangement once in vogue is shown in Fig. A. It is a glass vessel of globe or pear-like shape, ending in a tube. The top of the vessel has a glass stopper; the tube passes through the bung. The vessel is filled

with wine, and, as the level of the wine in the cask lowers down through evaporation the space is filled by the wine supplied by the glass receptacle fixed in the bung. As long as this receptacle contains any wine the cask may be thought to be well full. This arrangement is very deceiving, and cannot be recommended. In fact, the glass feeder on the bung while itself in ullage will cause its contents to go sour, hence one risks to fill up a cask with a liquid that has turned more or less acetic. Again, it may happen that, while the glass receptacle contains still some wine, the cask may be in ullage, simply because the wine from the feeder failed to run down into the cask. I said that this globe or pear-shaped glass has a glass stopper, and everyone will understand that it is likely to act as a velins when you put your finger and close the top end to stop the wine running, or the wine may run partially when the feeder has just been filled, and then stop on account of the atmospheric pressure under the bung being higher than that under the stopper of the glass feeder. It is for this same reason that when the tap is put to a cask the wine will not run unless the bung is lifted.

Great caution is necessary as to the quality of the wine used for filling up. It should be of the same type, or at least as good and perfectly sound. It would be a great mistake, implying certain loss, to fill up a cask of sound wine with an inferior or, still worse, with an unsound wine. Some people might think that adding a pint or two of slightly sour wine to a cask of 1,000 gallons is of little importance, and will do no harm. The harm on the contrary is great, and that small quantity is certain to spoil the bulk. A careful cellarman has always handy one or two quarter-casks of each type of wine in the cellar. They are for filling up the big vessels, and any left in the quarter-cask is put in keg and jars and bottles, so as not to leave in ullage the wine set apart for filling up.

It has been suggested by some to pour on the wine in ullage a layer of spirit, and naturally renew it at every racking instead of keeping up filling the cask with wine, which having to be done at so frequent intervals takes time and labour. The spirit being much lighter than wine will certainly remain on the top, and the *Diplococcus aceti*, which must necessarily start its baleful work from the top is thus prevented from developing and multiplying, spirit being a powerful preservative. However, the suggestion fails in practice. Spirit will certainly remain on the surface, yet it will mix more or less with the wine, and although the surface layers will be stronger in alcohol than the bulk underneath, yet in time the spirit will mix more and more until the strength will gradually become lower and lower, and finally may drop below 31° or 30° per cent. proof, when the same surface layers will become liable to acetification just as much as any wine with a smaller percentage of alcohol.

For the fortunate possessor of a vessel of real ancient wine it may be a rather difficult matter to find a suitable wine to fill the cask with. A very ingenious system has been suggested by M. Odart—that is, to drop into the vessel pebbles, after having made quite sure that they are siliceous, not

calcareous. The latter would affect the wine, inasmuch as its natural acids would react on the lime. Real siliceous pebbles are of the nature of the glass, and no harm is therefore to be anticipated. To make sure of the nature of the pebbles, the speediest way to test them is to treat them with a diluted solution of sulphuric or hydrochloric acid. If they make effervescence then they are calcareous, and should not be employed. The others are roasted to destroy any organic matter, then rinsed in fresh water. They will come out of the treatment quite clean, and ready for use. It may be objected that when dropping in the cask these pebbles the sediment will be stirred, but I am advising this device for ancient wines, which have practically no lees, and when the owner has no suitable wine to fill the vessel with.

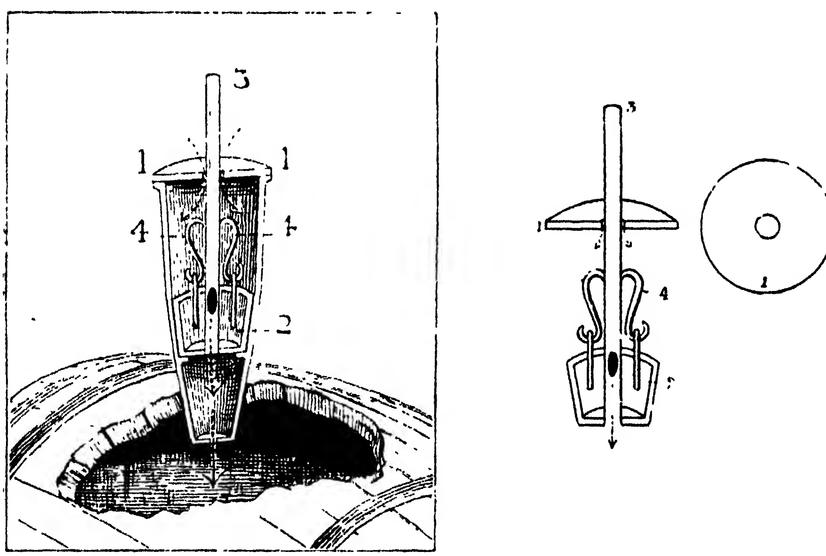


Fig. B.

In many restaurants and wineshops a vessel is often on draught, and there is no question of filling, and as often as not they cannot do it or will not do it. The consequence is that unless the wine is rapidly disposed of, by the time half the content is sold it becomes absolutely sour. Any man with cellar practice will know how difficult it is to make a sulphur strip burn in the ullage space, therefore, I advise the use of a sulphuring bung first devised by a M. Fage. It is of simple make, and any tinsmith could make one from this description. It consists of a cone made of tin, and of the shape of an ordinary bung, Fig. B. Inside there is a cup (2) with a stem open at the bottom and closed at the top (3), two opposite holes are on the stem, on which are also soldered two hooks (4), on which two pieces of sulphur strips are hung The bung has a lid (1) which has a hole in the centre, and can be lifted and

put back when ready. To put the bung in action lift the lid, remove the cup, and fix two sulphur strips on the two hooks, put the cup back and begin to draw off the wine from the tap only partially open, while at the same time

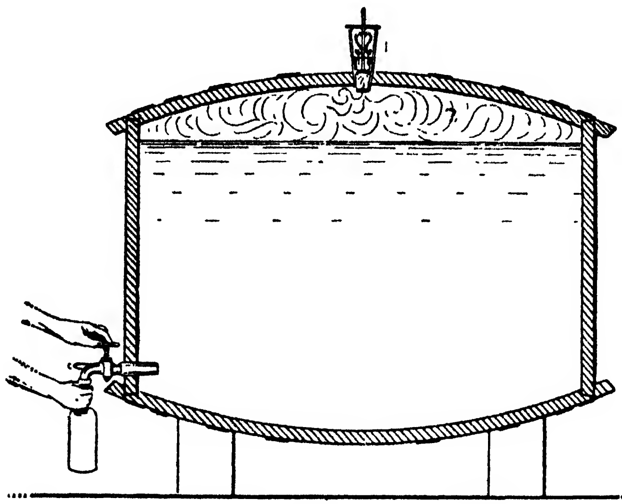


Fig. C.

light the sulphur strips inside the bung, and put lid back. When these begin to burn, open the tap fully (Fig. C), a strong draught will be caused by the

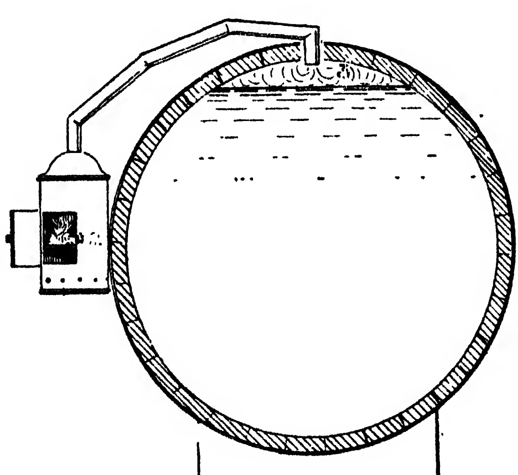


Fig. D.

running off of the wine, which draught is shown in its direction by the arrows in the sketch herewith. The draught will help the combustion of the sulphur,

and its fumes will rush into the cask, passing through the two holes on the stem attached to cup, said fumes filling the space equivalent to the volume of wine drawn off. When you have finished taking the quantity of wine you require, remove the sulphuring bung, and put back the ordinary one.

Other ways to fill with sulphur fumes the ullage left by tapping a cask is that illustrated by Fig. D, which is plain enough, and needs no explanation. Naturally the trick consists in setting the sulphur alight before beginning to draw the wine from the tap ; the draught caused by the efflux of the liquid will liven the combustion, while driving the fumes into the ullage as it forms. Also the bung should be blocked with a wet cloth, so that the air draught comes only from the burner aperture and through the neck leading the sulphur fumes into the cask. In fact, we all know that it is difficult to set a fire alight in the fireplace when all doors and windows are open, and to set a bad fire burning we often resort to the device of spreading a newspaper in front and quite close to the fireplace, so as to have a draught coming from underneath the grating.

The sterilizing bung devised by Signor Frattini is also meant for fixing on casks on draught. The air rushing into the cask, when wine is drawn off from the tap, bubbles through a layer of absolute alcohol, which stops the germs of diseases and destroys them. The alcohol is held in a sort of tumbler fixed on the bung. So far as the micro-organisms of the air are concerned this device is quite effective, but its oxygen reaches the wine all the same, and I have already said in the foregoing that germs of disease are present in the best of wines, and that they will develop when conditions are favourable. The oxygen in this case is supplied by the sterilized air just the same. However, the arrangement, though not filling all the conditions, is still a good way for reducing the inconvenience.

(*To be continued.*)

The Cattle Tick: Tick Infestation, Tick Fever, and Preventive Measures.

[Continued from page 952.]

JAS. D. STEWART, M.R.C.V.S.,
Government Veterinary Surgeon.

II.

Tick Infestation.

TICKS infest animals in their larval form. As previously stated, larval ticks frequent the free ends of blades of grass, leaves of shrubs, weeds, &c., and swarm upon any object that brushes past. If that object be a suitable host they attach themselves and commence their parasitic life.

Of Cattle.—Apart from causing "tick fever," which they are capable of doing if they are "infected," a few infesting ticks do not give rise to any appreciable inconvenience. But when they exist on a beast in numbers they cause constitutional disturbances, relative not only to the number infesting but also to the stage of their development.

The first indication of tick infestation is irritation, manifested by the host continually licking, scratching, or rubbing get-at-able parts. Larval ticks appear most active early in the morning, particularly after heavy dew, when from grossly-infested pastures they invade cattle and horses in myriads, and are specially noticeable where the hair is thin or absent. During the summer months, as the day advances, they are more difficult to detect, but may be readily seen close to the skin, by clipping the hair off likely places, such as the head, forearms, and breast. As a rule, they speedily attach themselves to their host, showing a preference for those parts where the skin is soft and thin, such as about the root of the tail, the escutcheon, udder (or scrotum in the male), inside thighs and forearms, under belly and breast. Soon evidence of local inflammation about their points of attachment becomes manifest by the formation of small pimple-like elevations in the skin, which may often be felt before they become perceptible to the eye, by passing the flattened fingers over the parts. These elevations become very evident as the ticks grow, and soon resemble shot-like swellings over which the hair has a tendency to stand erect. As the female ticks increase in numbers the irritation produced becomes so great that the infested beast is almost in a continuous state of unrest. When the matured tick drops from the host the seat of attachment remains permanently denuded of hair, so that in time the skin acquires a characteristic patchy baldness or "tick-marked" appearance.

Tick Worry.—The existence of the condition variously known as "tick worry," "tick poverty," "tick irritation," and "tick anæmia" was first clearly described in Queensland by the late Dr. Sydney Hunt in connection

with the Boolburra cattle. Boolburra is situated in Central Queensland, about 60 miles from the coast, and became grossly tick-infested. The cattle there were worn-down by ticks, and many succumbed to the anæmia and exhaustion produced; the degree of anæmia being roughly proportionate to the number of infesting ticks. When cleaned of ticks by dipping, the cattle speedily began to improve in condition and appearance.

During the exposure of a number of clean cattle from New South Wales to gross tick infestation at Greenfel, Queensland, in 1899, many showed severe symptoms directly attributable to the irritation caused by infesting ticks. In parts, such as the escutcheon, scrotum, and flank, where the ticks had attached themselves in countless numbers, the skin became inflamed, corrugated, and fissured; gangrene supervened, and often patches of skin the size of one's hand sloughed off, leaving nasty ulcerous sores, which quickly became fly-blown if left unattended. Pendant parts, such as the dewlap, sheath, and vagina became dropsical, and the superficial inguinal and prescapular lymphatic glands became much enlarged. The affected animals were dull and listless, not caring to move in search of food. As a rule they stood in the shade not far from water, lost condition daily, and soon presented a miserable appearance. On being dipped towards the end of the experiment, they, also, immediately began to regain condition.

It has not yet been definitely ascertained whether "tick worry" is produced by a specific cause, or due to several factors. In our present knowledge, the mechanical irritation caused by the ticks in their attachment, the loss of blood extracted by them, and particularly by the maturing females, together with the effects of toxines absorbed from the sloughing wounds, might reasonably be accepted as sufficient to account for the condition. It is, however, possible that the tick injects a secretion when it attaches itself, to help overcome the vital resistance of the host, so that the protozoan, if present, may flourish and produce the disease—"tick fever."

Cattle suffer more severely from "tick worry" when their fodder is dry and scarce, as during periods of drought. Invariably a liberal allowance of green succulent food materially aids them in their fight against the tick. Moreover, cattle newly exposed to infestation not only suffer greater from tick irritation than those accustomed to ticky pastures, but they become more grossly infested. Those born and reared on infested pastures seem to acquire a certain tolerance to the tick.

Of Horses.—A bay mare and a chestnut gelding were taken from the Richmond River district, New South Wales, to Greenfel, Queensland, and exposed to tick infestation for a period of nearly three months, during which they were kept under daily observation. They quickly became infested, as on the morning after their arrival numerous larval ticks were found attached to each of them, which soon began to grow, and on the twelfth day after exposure the "eight-legged" ticks of the first moult were observed. During the following few days it was noted that the number of first-moult ticks was considerably less than that of the previously infesting larval ticks, an

observation which appears to indicate that a large proportion of larval ticks infesting horses do not develop successfully. It is also interesting to note that maturing larval ticks removed from the horses and placed in glass receptacles died within twenty-four hours, while those removed from cattle, and tested in a similar manner, were alive and active at the end of that period. By the nineteenth day many ticks were observed to have become sexually mature, and on the twenty-fifth day, engorged female ticks were removed from both horses. A number of the engorged female ticks were placed in glass receptacles, and on the fifth day oviposition commenced. During the following ten days each female had laid between one and two thousand eggs, whose size and form appeared identical with those laid by ticks that had matured on cattle about the same time. On the eighteenth day after oviposition the eggs began to hatch out, and the larval ticks appeared very active.

The life cycle of ticks maturing on horses was thus successfully completed, and while the metamorphoses was practically identical with that passed on cattle, the period occupied was greater. It was also observed that the larval ticks maturing on horses were paler and plumper than those maturing on cattle, while many of the full-grown females were of greater length but not so round in contour as similar ticks removed from cattle. The variation is apparently, due to the fact that the blood of horses is not so suitable a food for the tick as that of cattle.

Tick irritation is more keenly felt by horses than by cattle. Not only do they rub themselves more violently, but they nibble and bite affected parts until bleeding abrasions are produced. Often two horses are seen standing head to tail beside one another nibbling each others back and neck. The shot-like elevations are very pronounced, and they increase in size until the base of the swelling often equals in diameter that of a sixpenny piece. They are best seen on the neck and breast. Owing to the skin of horses being more sensitive, sloughs are more common than in cattle. There is no doubt the horse removes a great number of infesting ticks by nibbling and rubbing. Consequently, the mane and the tail are favourable sites for the development of the tick, and it is in these positions that mature females are commonly found even when the remainder of the body is clean. This fact should be prominently borne in mind when inspecting horses for tick infestation.

Running in the same paddock with the experimental horses were two others that had, judging from the tick-marks on their skins, experienced their first infestation a year or two back. While our experimental horses were vigorously exhibiting symptoms of tick irritation, the latter were calmly feeding, and apparently indifferent to the presence of ticks. On closer inspection, it was found, however, that these horses were not infested to anything like the same degree that the experimental horses were.

It would, therefore, appear that, as with cattle, horses in time become to an extent inured to the tick.

(To be continued.)

Orchard Notes.

W. J. ALLEN.

NOVEMBER.

THE most important work for all orchardists at this time of the year is cultivation; as, in most places, if this important work is neglected at this particular season, there is but little hope of harvesting crops of fruit which will reflect much credit on the grower when placed upon the market, nor will the proceeds from same materially swell the banking account. I would, therefore, urge on all our growers the necessity for keeping their land well worked up to a good depth, and under no consideration leave the ploughing too late in the spring, as during most seasons we require all the moisture which we can possibly conserve in order to keep the tree in a healthy and growing condition, so that, in its turn, it may be able to supply the fruit with the required nourishment to bring it to maturity. Therefore, work the land well in the early spring, and from that time see that it is kept loose by repeated cultivations—not ploughings—as the latter process, during dry hot weather, turns up the moist land to the weather, and in place of conserving the moisture allows it to escape. Hence, in summer months, never plough, but keep the land thoroughly stirred to a depth of 4 or 5 inches by running the cultivator over it at frequent intervals, thus keeping the surface worked up to a fine tilth.

Towards the latter part of this month, the earlier varieties of peaches, cherries, and apricots will find their way into the markets. The grower should grade and pack these honestly, in the most attractive way, so as to attract the attention of the public when exposed to view in the market, and thus command good prices.

Summer pruning may be started this month, and it is well to go over and regulate the growth of all young trees, thinning and shortening back where required—that is, where the tree is growing too thick—and pruning or pinching back so as to keep the tree evenly balanced and symmetrical. This early summer pruning is more for young trees, to aid in directing the growth to that part of the tree where it is most required.

December and January are the months for summer pruning the older trees in order to force out fruit spurs and buds.

In districts where the fruit-fly has been troublesome in previous seasons, I would recommend growers to be particularly careful in picking up and destroying all fallen and fly-infested fruits, and boiling them, in order to ensure the destruction of all larvæ which may be contained therein. As

this is the only sure way at present known of helping to keep down this pest, I would urge on growers the importance of doing their best to destroy it.

Where irrigation is practised, a thorough watering should be given all trees towards the end of the month. This should be the second watering of the season. Be most careful to keep the water confined to the furrows, as, wherever the land is flooded, it is liable to become hard. As soon as the furrows are dry enough to work, cultivate the orchard twice, and loosen the soil around any young trees with a fork hoe.

Every care should be taken to destroy the codling moth, which makes its appearance about the time the apple-trees finish blooming, lays its eggs in the young fruit and leaves, and after hatching, works its way into the apple, and within a few weeks emerges and lowers itself down to the ground by a silken thread, and immediately seeks shelter by crawling up the tree and getting into any crack or underneath any old loose bark, either on the tree, on props, or any loose rubbish which will provide a hiding place. The orchard should therefore be kept free of such rubbish, and all trees bandaged at a height of about 10 inches from the ground. The grubs will harbour in the bandages, which should therefore be removed every ten days, and all grubs killed. Pick up and destroy all fallen fruit.

Pruning of citrus trees may be continued wherever not completed.

Pruning and manuring of passion-fruit vines may be carried out the early part of this month.

Wherever Thorny Mandarins show signs of cropping too heavily it will be well to prune them a little more severely, as well as removing some of the fruit from the tree, so that the latter will not over-bear and exhaust itself this season. If allowed to over-bear the fruit will be small and almost worthless.

Budding of citrus trees may still be carried on.

All citrus trees attacked by Maori or fungus diseases should be sprayed with Bordeaux mixture. In applying a spray like Bordeaux mixture to citrus trees, it will be found advantageous to apply the mixture in a small quantity at a time in two successive sprayings, rather than one heavy application which may run off the smooth surface of the young fruit.

Never fumigate trees for several months after they have been sprayed, as, if they are so treated, all the leaves will fall off, many of the smaller twigs and occasionally the top part of the tree will be killed.

Single and Two-horse Plough.

These are two ploughs which we use in our Wagga orchard. They can be set so that the horse can walk clear of the trees or vines, and yet they can be made to turn over the soil quite close up to the trees; in fact, it is for that part of the work which we keep them, as they are brought into requisition after the three-furrow plough has covered as much of the land between

the rows of trees as it is possible for it, or when the soil is thrown towards the trees they are used to turn the first two or three furrows, after which the large plough is used. They are also good for ploughing under crops of green manure, and the larger one for breaking up new ground, where two or three-furrow ploughs are not required.

Single and Two-horse Plough.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

Directions for the Month of November.

Vegetables.

The prospects of a favourable time for gardening during November are good so far as an ample rainfall is concerned; the only danger to fear, judging from present weather at time of writing, are floods and excessive wet, which may injure some kinds of vegetables on ill-drained land, more particularly roots—potatoes, onions, and others; but a deal can be effected to remedy this in drawing away from the garden any excess of water. As far as possible, digging should be avoided as long as the ground is wet, especially heavy land; cultivation amongst the vegetables, too, for destroying weeds will be out of the question; but if young weeds are plentiful, it may be possible to get rid of numbers by hand-picking. Where the ground has become covered over by the rapidly-growing vegetables, the weeds are not likely to cause any injury, but it is the small seedlings and recently planted-out vegetables that are likely to suffer if the hand weeding is not resorted to, for the weeds grow so quickly that in a day or two they may completely overmaster the young plants.

Some little care should be taken of any manure that may have been collected in heaps, or in pits, for the garden, in protecting it from heavy rains. A covering of bark, boards, or old iron sheeting may serve the purpose. If the heavy rains are allowed to wash through the manure, most, or a great deal of the best of it will probably be washed out and lost. At the same time the manure heap should not be allowed to become over-dry, but should be kept sufficiently moist to prevent its becoming overheated or "fire-fanged," for then it is not likely to decompose or rot, as is desirable.

The raising of seedlings for planting out requires some little care, and a few frames covered with light brushwood, laths, or light material, for shading the seed-beds, boxes, or pots in which the seeds are sown. Regularity in watering is very necessary; that is to say, water should be supplied sufficiently often to prevent the soil becoming dry. A day or two of drought may prove fatal to seeds just germinating, and loss of seed and loss of time will follow.

After the seedlings have been raised of those kinds of vegetables which are, or can be, planted out, they should be "pricked out"—a gardening term, which means really to plant out rather close together, where the seedlings are better able to develop quickly and well, and become prepared for the final planting. This pricking out causes the better production of roots of some of the different kinds of plants, and the little trouble of this pricking out will be well repaid in the more satisfactory and more even growth of the vegetables.

Beans, French or Kidney.—There should be little or no difficulty in growing this useful summer vegetable during the present favourable season. Both dwarf and runner varieties should be tried, and various kinds of these two sections as well. If, during the latter part of September, a good supply of seed had been sown, it may not be necessary to sow any more until the middle or end of November, to keep up the supply.

Beans, Lima.—If the bean pods be gathered regularly from the plants, as soon as the seeds are large enough for use, the plants will continue to produce pods during the season, and it may not be necessary to sow any seeds again, that is if plants have already been raised.

Beet, Red.—This vegetable should be grown so extensively that there should be sufficient roots for almost an every-day supply during the summer and autumn, and wherever it will grow during the whole year through it should be grown. The large tap-rooted varieties are now but seldom used, the globe or turnip-rooted varieties being much preferred—being more satisfactory to produce. Sow in rows where this kind of beet is to be grown, about 1 foot or so apart, and when the beets come up thin out to about 8 inches or 1 foot apart, taking the precaution of removing all plants showing white or pale coloured leaves, for these would produce light-coloured roots, which is an objectionable character, for the darker the colour of the roots the better they are esteemed, and probably with reason.

Beet, Silver or Spinach.—Seeds may be sown if more plants are required. As this beet is used for the leaves only, and as it is very productive if well treated and looked after, there will be no need for many plants, and a sowing of a few seeds once in two months or three months will be found sufficient for domestic purposes.

Broccoli.—A little seed may be sown in seed-bed or box. Prick out from previous sowings and plant out advanced broccolis.

Cabbage.—For summer use the well-known St. John's Day is one of the best. Succession should do well this season, and also one named Phenomenal, if seed can be obtained. Sow sufficient seed to keep up a supply of plants for pricking out ready for planting when required. Use abundance of well-decayed manure for cabbage, although it may be grown in some rich soils, in a moist season, without the application of manure; but it is seldom that the soil is so good that manure will not be of benefit to cabbage, cauliflower, broccoli, and others of the same class of vegetables. Plant out a batch of advanced cabbages.

Cauliflower.—It will be worth while to try a little seed, and plant out any young cauliflower ready for the purpose, but the plants must not be checked in any way; their growth should be vigorous from start to finish, or else they will "button" and not produce good heads.

Carrot.—Sow a little seed occasionally, in order to keep up a regular supply if possible.

Celery.—A very desirable vegetable for summer use, and worth a good deal of trouble to produce. Sow a pinch or so of seed occasionally in order to ensure a supply of seedlings for pricking out and subsequent planting.

Plant out advanced seedlings in a heavily-manured bed. Half a dozen plants a week should be sufficient to set out. Make shallow trenches and plant the celery one foot apart. Full-grown plants, or those nearly full grown, should be earthed up and bleached in any way convenient. The principle to understand is that the light must be kept away from the leaf stalks.

Cucumber.—Seed may be sown if the plants now growing are not considered to be sufficient. Advancing plants should have their shoots pinched, to cause the development of lateral branches. Early raised plants in the warm districts should be producing cucumbers freely during the month.

Cress and Mustard.—Keep up a supply as long as possible, for it is very useful as a salad with lettuce, endive, and other plants. Sow from time to time during the month.

Egg-plant.—Seedlings may be planted out in almost any district during the month. In the warm districts plants should be in flower and producing fruit.

Leek.—Sow a little seed, prick out advancing seedlings, and plant out young well-grown seedlings to well-manured ground.

Lettuce.—Sow seeds in rows where the plants are to grow, for it is risky during the summer months to transplant this vegetable. Thin out well after the seedlings have made some advance, and cultivate the plants well to encourage speedy growth.

Maize, Sweet.—Sow the seed in rows 4 feet apart, and drop the seeds about 1 foot apart in the rows. Cultivate well for as long a time as possible.

Melons.—Sow seeds as largely as may be required in almost any part of the State. Keep the growing plants compact by pinching.

Onions.—A little seed may be sown, either for raising young onion plants for transplanting, or in the usual manner in a bed. The latter will be, perhaps, the best method at the present time of year.

Peas.—A few rows may be sown. These are likely to thrive best in the cooler parts of the State.

Pepper, Chili, or Capsicum.—These are different names for the same vegetable. Seedlings may be planted out if ready, or seed may be sown freely. Two or three plants will probably suffice for any family. The small varieties are the hottest in flavour, and the largest are the mildest.

Potatoes.—A row or two may be tried towards end of month, and should probably succeed, if potato "seed" can be obtained, which may be difficult until somewhat later.

Pumpkin.—Seed may be sown freely almost anywhere. Plants of early sown seed should be progressing favourably. They should be pinched occasionally, but not too closely, or so closely as melons or cucumbers, for they are much stronger growing plants.

Radish.—Sow a little seed occasionally, just to keep up a supply.

Rhubarb.—If plants of this vegetable are required for next year's planting, they can easily be raised from seed, which may be sown during the month. Prick out the seedlings rather wide apart, as soon as they are large enough to move, and plants should be ready by next winter for planting out.

Sweet Potatoes.—Rooted cuttings should be ready by this time for planting out; but if not, some sweet potato tubers should be started into growth, and as soon as the vines have made sufficient growth cuttings should be taken and rooted. Plant the root cuttings in rows about 4 feet apart, about 1 foot from each other.

Spinach.—A little seed may be sown.

Tomato.—Sow seed if sufficient plants have not yet been raised. Plant out seedlings as soon as possible, and train them as they grow to stakes, wire netting, or anything else convenient. Training to single stems will be found simple and effective. All side shoots should be pinched out as they appear.

Vegetable Marrow and Squash.—Sow as extensively as may be required.

Flowers.

Flowers of very many species should be abundant during the month, for the season has been extremely favourable for garden plants of all kinds.

Dahlias may be planted at any time during the month, and as soon as they begin to grow, all shoots but one should be removed, and this one should be tied up to a stake as it grows. The cactus is the most popular and the most useful and effective section, and is by far the most satisfactory to grow. There are many beautiful varieties in this section, of various shades of colour. In order to grow good flowers the plants will need attention. The soil should be good, or made good by liberal manuring, and, if the weather proves dry, watering plentifully may be necessary. Chrysanthemums may be planted out, and, should the weather be dry, the plants must be well watered and attended to until they have become well established. The best flowers are produced on plants with single stems, all suckers being removed as they grow.

After the great spring-blooming of roses is over the plants should be pruned slightly, removing all seeds, and, if necessary, thinning out some of the branches if they are growing too dense. At the same time, especially if the roses are growing in inferior soil, the application of a half bucket of liquid manure to each rose will be advantageous, and should assure another good flowering of the tea-scented and hybrid teas, and also, to some extent, other kinds.

Plant out zinnia, celosia and other kinds of amaranths, and also balsam seedlings.

Balsams may be transplanted several times, and the more they are shifted, whilst small, the better they seem to flower, and it is much the same with zinnias.

Farm Notes.

Hawkesbury District—November.

H. W. POTTS.

The weather conditions of last month were unfavourable to good growth, seeing the beneficial effects of the light spring rains were largely nullified by the prevalence of drying, bleak, westerly winds. Frosts, fortunately, have not appeared. The spring of grass which we usually depend on at this time of the year is short and not abundant.

Notwithstanding these drawbacks, the hay harvest will prove much heavier than was anticipated, and will not fall far below the average in quantity. The quality, however, is affected through the prevalence of rust. The early wheat crops are badly affected.

November is a busy month, seeing full preparations must be made for harvesting operations. The rapid advance of summer will cause the hay and grain crops to overlap. This entails a greater strain on labour, horses, and implements. In making hay, the early flowering stage, in many cases, is accepted as the signal for commencing to cut. The aim is to select the period in which the plant has developed its maximum growth of digestible nutrients, and is also in its most palatable condition for stock. For market purposes as chaff, the retention of the green colour in the straw is of commercial importance. Buyers are always prepared to give a good price for chaff bright and green in appearance.

The old method of cutting hay with the mower is slowly disappearing. The reaper and binder takes its place, and does the work more expeditiously and economically. It gives greater assurance of quality, and saves labour in handling. The operation of chaff-cutting is facilitated when the hay is in sheaves, the chaff is more evenly cut, presents a better appearance, and, naturally, more readily realises a higher price. The sheaves should be stooked immediately after cutting, and, seeing that the weather is inclined to be unsettled in November, it is well to stook the sheaves so as to repel rain. Whilst air may be freely admitted to hasten the curing stage, the sheaves should be arranged to prevent rain entering them. Weather conditions have to be carefully studied and estimated to determine how long the stooks shall stand to ensure good curing. First, the sheaves should not be large. Medium-sized sheaves cure better. Stack before the sheaves get too dry. They do not lose weight or condition in the stack, and practically come out as they went in. If they are permitted to become too dry before stacking, then the hay splits when chaffing, and gets dusty. Good judgment has to be exercised in curing to secure a good-coloured chaff, palatable, clean and bright in character.

Lucerne hay making will also occupy attention. This hay has no equal as a dry feed for live stock. But it must be remembered that no other sort of

hay demands as much intelligence and skill in conserving all its qualities. The greatest attention is required in deciding the stage at which it shall be cut. As the plant begins to blossom the stems begin to turn indigestible, and lose their food value. Later on the hardened stems lose their leaves, and when cut produce an unpalatable, innutritious and inferior hay. The leaves of the plant contain nearly four times as much protein or flesh-forming food as the stems in their best condition, and therefore it is very desirable that in curing lucerne hay every effort should be made to retain the leaves. This is often a difficult task, particularly when the plant has made rapid growth, is very succulent, and the weather is moist. If freely exposed to the sun the leaves dry rapidly and become brittle before the stems are cured. In making the hay we aim at avoiding loss of leaves and colour, and securing the greatest food value. The first cuts of the season are always the most difficult to cope with. Owing to the succulence or sappy nature of the crop, a special feature in cutting lucerne is the best time to cut, or the stage of the growth of the plant most profitable. Scientific investigation has clearly shown that the right time to cut to secure the greatest advantage is when one-tenth of the crop is in bloom. This is when the plant contains the highest proportion of albuminoids or protein. The nutritious elements have been carefully estimated at various stages of maturity to arrive at this important determination. When the plant has made slow growth, and the weather is dry, there is little or no trouble in curing the hay. It has been found the best plan to mow close to the ground. This is often termed "shaving" the ground. A close cutting is credited with the property of increasing the density of the sward, and checking the crowns hardening, and encouraging a growth of crown below the soil surface. The utmost care must be exercised in handling lucerne after it is cut to prevent the leaves drying and cracking too much and falling from the stems. The mowing should be done in the morning, and the crop put into windrows and stacked towards evening. Get it in green and fairly pliant. It is surprising to what extent lucerne may be stacked in a green condition and fairly moist. Much, however, depends on prevailing conditions. The exercise of common sense is needed at every stage to forecast the results accruing from the methods followed.

Maize.—The early crops are above ground, and will, in consequence of the shortage in rainfall, demand continuous attention. Shallow cultivation must be followed to check the growth of weeds and conserve moisture. The bald fact is apparent that we had no winter rains. The subsoil moisture is scant, and it will require all our knowledge of dry farming and its practical application to bring the crops to maturity this summer. Weeds not only utilise soil moisture but also the plant-food, and hence should be conspicuous by their absence in maize fields. The depth to cultivate should not exceed 3 inches, owing to the possibility of pruning or cutting the plant rootlets. Whenever a thunderstorm breaks with a fall of rain or light showers, full cultivation should follow promptly. Further sowings of maize may be made, particularly those varieties intended for ensilage at the end of the summer.

Sorghums.—We cannot afford to ignore those valuable crops for forage this season. We are yearly being provided with further evidence of the high value they are to dairy-farmers, especially in providing a green, nourishing fodder at a time when other succulent foods are absent, and will do this up to the middle of July. The Imphee varieties. Sorghum saccharatum, Planter's Friend, and Early Amber Cane, can always be grown with good returns.

At this period it is well to remember that we must have a shortage of food for stock towards the end of summer, and now is our opportunity to provide for it. Sorghums require much care and continued attention during the early progress of their growth. The plant is inclined to be delicate, and easily checked; hence constant cultivation is essential until it is firmly established. The results of this are more readily secured on light, sandy loams. Equal parts bone-dust and superphosphate form a good, stimulating manure applied at the rate of 1 cwt. per acre. Sorghums are available for green feed in summer, and can be cured as hay or conserved as ensilage.

Millets.—All chances of frost are now over, and these useful and quickly-growing forage plants may be sown at once. Of course, the seed needs moisture to ensure rapid germination. The soil requires to be in a condition of fine tilth, and it will be all the more suitable if it be rich in humus. Clay and sandy loams give good results. The millet crop possesses the advantage of occupying the land only a comparatively short time, and, in addition, acts as a cleaning crop. Millet will withstand the severe conditions of a warm summer. The best varieties for our districts are the White French, Hungarian, Chinese White, Turkish, and Manitoba. The forage is ready in sixty to eighty days, and, when cut or eaten off, may be followed by a second growth.

Sweet Potatoes.—The propagation of this edible tuber is now considered an important section of farm work in this district. A full growth is obtained on our light, sandy loams, and it revels in heat. Either for household use or for pigs it may be grown to advantage. A further planting may be made this month.

Cowpeas.—Our experience in the past is being yearly strengthened as to the value of cowpeas as a green fodder for midsummer to be grazed by stock. For the rotation it certainly fills in gaps, and provides that enriching element, nitrogen, which is so liberally obtained from clovers, vetches, and other legumes in colder climates. Last year, during a very hot spell, ranging up to 112 deg. Fahr. in the shade, cowpeas provided our stock in January and February with rich, palatable, green succulent forage for grazing when other fodders were scarce. The early maturing sorts, such as Black, White, Whip-poor-Will, Warren's Extra Early, and Iron, may be sown this month.

Pumpkins, Marrows, Squashes, and Melons.—These dry-weather plants may be sown in suitable soils and in situations where cultivation can be applied.

Mangolds and Sugar Beets.—The late crops may now be sown. The early ones will require attention by thinning-out and cultivation.

Glen Innes District—November.

R. H. GENNYS.

Maize.—Early maturing varieties such as Iowa Silvermine, Pride of the North, and Cinquatina, may still be sown for grain. For green feed and for ensilage, sow Hickory King and Early Leaming; they grow good tall stalks, and are very suitable in this latter connection.

Millets.—May be sown freely either for hay, green-feed, or seed. Hungarian and New Siberian are the best for hay. White Italian is the best to grow for broom millet.

Sorghums.—Amber Cane and Planter's Friend are two that have done the best here. It might be noted that cattle should not be allowed to feed on young sorghum, as many have been lost through eating it before it comes to a head; it should always be sown within a very secure fence.

Potatoes.—Sow sorts for main crop towards the end of the month, but not too early—the beginning of December will be better. In this connection Brownell's Beauty is recommended.

Vegetables.—Pumpkins, melons, beans, cucumbers, &c., may be planted. Work the orchard to kill weeds and conserve moisture.

Draining.

The stiff soils of New England, above all things, require to be drained, and summer crops as well as winter crops need it; on low-lying soils, and those with a too retentive subsoil, no grain nor fodder-crop can mature properly where stagnant water lies either on or close to the surface. Stagnant water saturates the soil completely, to the exclusion of the air, which is quite as necessary to plants as water itself. Deleterious acids too are formed, and lime put on after draining tends to neutralise the effect of these; it sweetens the soil and makes valuable plant-food available. Draining does not take away too much water from land, but sufficient is left for the growth of plants, leaving space for the circulation of the air as well as the water. In going through the soils to the drains water percolates through quickly, leaving behind it valuable plant-food, so that heavy downpours are not a curse—as is often the case here—but a blessing on drained land. Some nitrogen however is lost in drainage; but it is in part made up for by that which is left during the passage of the water. In dry weather drained land generally comes off the best, especially if the surface is cultivated; it does not shrink, crack, and expose the roots to the heat of sun and hot winds, like undrained soil, and is sweeter and better in every respect.

Crown Lands of New South Wales.

THE following areas will be available for selection on and after the dates mentioned:—

FOR CONDITIONAL PURCHASE LEASE—(Available under Section 10 of Act of 1905. Regulations 356 to 365. Applications to be made on Form No. 114.)

C.P.L. No.	Name of Land District	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date Available.
			a. r. p.		£ s. d.	1906.
37	Windsor	1	77 1 15	Richmond, 22 miles.	3 4 6	20 Dec.

Being portions 1, 2, and 3, parish of Wheeney, county of Cook, about 12 acres swampy land in portion 1, suitable for maize growing if drained; balance light loamy soil, suitable for orchards; timber—gum and turpentine and ti-tree, fringing swamp; no permanent water.

FOR ORIGINAL CONDITIONAL PURCHASE ONLY—(Classified under Subsection 1 (A), Section 4, of Crown Lands Amendment Act, 1905; available under Section 26 of Act of 1884. Regulations 74 to 130. Application and declaration to be made on Forms 21 and 22).

Name of Land District.	Name of Holding, &c.	Parish.	County.	Total Area.	Price per Acre.	Date available.
				acres.	£ s. d.	1906.
Armidale	....	Guyra	Sandon	200	2 5 0	20 Dec.
On Guyra Creek; good grazing land, parts suitable for cultivation.						
Armidale	... ..	Hillgrove	Sandon	160	1 15 0	27 Dec.
Good grazing land.						
Cootamundra	....	Yeo Yeo	Bland		2 0 0	13 Dec.
Suitable for dairying and agriculture.						
Grafton*	Within Grafton population area.	Elland	Clarence	765¾	1 10 0	8 Nov.
Being portions 45, 47, 48, 49, 58, 60, and 66; undulating country of basaltic and trap formation, thickly timbered with gum, oak, and ironbark; grazing country, parts suitable for cultivation; water generally present in creeks, and may be easily conserved.						
Tamworth	....	Walcha and Ainsley	Parry	5,300	1 0 0	8 Nov.
Suitable for grazing.						

* Identical with special area (see page 1171).

For Original Conditional Purchase and Conditional Lease in virtue thereof—(Classified under Subsection 1 (b), Section 4, of Crown Lands Amendment Act, 1905; available under Sections 26 and 48 of Act of 1884. Regulations 74 to 130. Application and declaration for Original Conditional Purchase to be made on Forms 21 and 22, and for Conditional Lease on Forms 95 and 96).

Name of Land District.	Name of Holding, &c.	Parish.	County.	Total Area.	Price per Acre.	Date available.
				a. r. p.	£ s. d.	1906.
Albury	....	Castlestead.. ..	Hume	290 0 0	3 1 8	6 Dec.
		Suitable for wheat growing.				
Albury ..	....	Creighton	Hume ..	240 0 0	2 15 0	29 Nov.
		Suitable for grazing and agriculture.				
Armidale ..	....	Metz	Sandon	117 1 23	1 10 0	15 Nov.
		Being portions 382 and 383. Suitable for grazing.				
Barmedman ..	....	Thanowring ..	Bland ..	500 0 0	1 16 8	13 Dec.
		Suitable for agriculture.				
Barmedman ..	Mimosa	Ingalba	Bourke ..	570 0 0	1 5 0	13 Dec.
		Suitable for grazing and agriculture.				
Carcoar	.....	Wangalo ..	Georgiana ..	92 0 0	1 0 0	20 Dec.
		Suitable for grazing.				
Carcoar	....	Grabine and Yewrangara.	Georgiana ..	415 0 0	0 15 0	20 Dec.
		Suitable for grazing. On Sandy Creek.				
Carcoar	.....	Grabine and Yewrangara.	Georgiana ..	830 0 0	1 0 0	20 Dec.
		Suitable for grazing. On Sandy Creek.				
Coonabarrabran.	Bald Ridge ..	Piambra ..	Napier ..	80 0 0	1 5 0	15 Nov.
		Being portions 77 and 87. Suitable for grazing and agriculture. On Castlereagh River.				
Lismore ..	....	Byron	Rous ..	329½ 0 0	1 0 0	29 Nov.
		Being portions 178 to 180. Suitable for grazing and for dairying, when drained.				
Murwillumbah.	....	Terranora	Rous.. ..	725 0 0	0 15 0	29 Nov.
		On Brady's and Cobaki Creeks. Suitable for grazing.				
Murwillumbah..	....	Terranora	Rous.. ..	460 0 0	1 0 0	29 Nov.
		On Brady's and Cobaki Creeks. Suitable for grazing.				
Muswellbrook ..	....	Worondi	Brisbane ..	550 0 0	1 0 0	29 Nov.
		On Worondi Rivulet. Grazing land; part suitable for agriculture.				
Scone	....	Tyrone	Brisbane ..	155 0 0	1 11 8	29 Nov.
		On Wybong Creek. Suitable for grazing and agriculture.				
Tamworth ..	....	Currabubula ..	Buckland ..	208½ 0 0	1 0 0	15 Nov.
		Being portion 326. Suitable for grazing.				
Tamworth ..	....	Walcha	Parry ..	700 0 0	1 0 0	8 Nov.
		Suitable for grazing.				

CONDITIONAL PURCHASE (ORIGINAL OR ADDITIONAL) OR CONDITIONAL LEASE—(Available by revocation of reserves, and not classified or specially set apart under Section 4 of the Crown Lands Amendment Act of 1905; available under Sections 26, 42, and 48 of Act of 1884. Regulations 74 to 130. Application and declaration for Original Conditional Purchase to be made on Forms 21 and 22, and for Additional Conditional Purchase or Conditional Lease on Forms 95 and 96).

Name of Land District.	Name of Holding, &c.	Parish.	County.	Total Area.	Price per Acre.	Date available.
				a. r. p.	£ s. d.	1906.
Gundagai ..	....	Calafat .. .	Wynyard ..	1,500 0 0	1 0 0	29 Nov.

CONDITIONAL PURCHASE AS SPECIAL AREA.

Grafton Land District, within Grafton Population Area, 765¾ acres, in parish of Elland, county of Clarence, maximum area 175¾ acres, minimum area 44¼ acres; undulating country of basaltic and trap formation; thickly timbered with gum, oak, and ironbark; grazing country, parts suitable for cultivation; water generally present in creeks, and may be easily conserved; price £1 10s. per acre. Available for original applications only on 8th November, 1906.

FOR IMPROVEMENT LEASE—(Available under Section 26 of Act of 1895. Regulations 157E to 160 and 250 to 262A. If not bid for at auction may be subsequently applied for on Form 91).

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Upset Annual Rental per Block.	Date of Sale or Tender.
		CENTRAL DIVISION. (West Bogan Scrubbed Lands.)					
			acres.		acres.	£ s. d.	1906. Sale.
658	Nyngan	Panjee Resumed, 175	... .	1	5,025 (ex roads).	26 3 6	13 Nov.

Level and undulating country; fair to good red sandy loam; timbered with box, pine, yarran, and some mallee. No natural water supply; distant 18 miles from Hermidale. (The upset annual rental covers the present value of scrubbing done on this block, so that no further payment is asked in respect of such expenditure.)

AGRICULTURAL SOCIETIES' SHOWS.

1907.

Society.	Secretary.	Date.
Dapto A. and H. Society (Jubilee Show)	Geo. Lindsay	Jan. 9, 10
Albion Park A., H., and I. Society	H. Fryer	,, 16, 17
Central Cumberland A. and H. Association	H. A. Best	,, 25, 26
Kiama Agricultural Association	James Somerville	,, 26, 28
Berry Agricultural Association	A. J. Colley	,, 30, 31, Feb. 1, 2.
Wollongong A., H., and I. Association	J. A. Beatson	Feb. 7, 8, 9
Shoalhaven A. & H. Association, Nowra	W. Randall	,, 13, 14
Moruya A. and P. Society	John Jeffery	,, 13, 14
Tamworth A. Association	J. R. Wood	,, 19, 20, 21
Kangaroo Valley A. and H. Association	E. G. Williams	,, 21, 22
Alstonville Agricultural Society	W. W. Monaghan	,, 27, 28
Gunning P. A. and I. Society	W. T. Plumb	,, 18, Mar. 1
Robertson A. and H. Society	R. G. Ferguson	,, 28, ,, 1
Manning River A. and H. Association, Taree	S. Whitbread	,, 28, ,, 1
Tenterfield Intercolonial P., A., and Mining Society	F. W. Hoskin	Mar. 5, 6, 7
Braidwood	L. Chapman	,, 6, 7
Berrima A. H. and I. Society	J. Cullen	,, 7, 8, 9
Blayney A. and P. Association	H. R. Woolley	,, 12, 13
Gundagai P. and H. Society	A. Elworthy	,, 12, 13
Central New England P. and A. Assoct'n, Glen Innes	Geo. A. Priest	,, 12, 13, 14
Warialda P. and A. Association	W. B. Geddes	,, 13, 14, 15
Goulburn A., P., and H. Society	J. J. Roberts	,, 14, 15, 16
Newcastle A., H., and I. Association	Owen Gilbert	,, 14, 15, 16
Armidale and New England P., A., and H. Associat'n	A. McArthur	,, 19, 20, 21, and 22
Camden A., H., and I. Association	C. A. Thompson	,, 20, 21, 22
Inverell P. and A. Society	J. McIlveen	,, 20, 21, 22
Mudgee Agricultural Society	J. M. Cox	,, 20, 21, 22
Crookwell A., P., and H. Association	C. T. Clifton	,, 21, 22
Upper Hunter P. and H. Association, Muswellbrook	Pierce Healey	,, 21, 22, 23
Walcha P. and A. Association	S. Hargrave	,, 27, 28
Royal Agricultural Society of New South Wales	H. M. Somer	,, 26 to April 3
Yass P. and A. Association	W. Thomson	April 9, 10
Orange A. and P. Association	W. Tanner	,, 10, 11, 12
Bathurst A., H., and P. Association	W. G. Thompson	,, 17, 18, 19
Cooma P. and A. Association	C. J. Walmsley	,, 24, 25
Durham A. and H. Association (Dungog)	C. E. Grant	,, 24, 25
Richmond River A., H., and P. Society (Casino)	E. J. Robinson	,, 24, 25
Macleay A., H., and I. Association, Kempsey	Ernest Weeks	,, 24, 25, 26
Clarence P. and H. Society, Grafton	T. T. Bawden	,, 30, May 1, 2
Lower Clarence A. Society	G. Davis	May 7, 8
Central Australian P. and A. Association (Bourke)	G. W. Tull	,, 22, 23
Murrumbidgee P. and A. (Wagga Wagga)	A. F. D. White	Aug. 21, 22, 23
Junee P. A. and I. Association	T. C. Humphrys	Sept. 4, 5
Young P. and A. Association	G. S. Whiteman	,, 11, 12, 13

[1 plate.]

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Agricultural Gazette of New South Wales.

Descriptive Notes on typical varieties of Wheat grown in New South Wales.

F. B. GUTHRIE.

The following notes concerning the varieties of wheat most commonly grown in New South Wales were compiled at the instance of the Agent-General, who desired information regarding the wheats grown in the State for distribution among English and continental wheat buyers. At the same time they will, it is hoped, be of value to our own farmers in supplying information concerning the different varieties and their suitability for the various districts. Attention is especially drawn to the growing demand for strong-flour wheat. Mr. Coghlan reports that "there is a very keen demand among English buyers for wheats of the Fife class, especially when there is a shortage of supplies from the countries from which they usually obtain them. The prospect of stocks of these wheats being obtainable, perhaps in the near future, from Australia, has created very much interest in the minds of merchants and millers."

The cultivation of pure Fife wheats is not likely to become universal in New South Wales, as they are not suited to the warm, dry districts which constitute the bulk of the wheat-growing area of the State. They are late in maturing, are affected by hot winds, and not sufficiently drought-resistant for successful cultivation under the conditions prevailing over the greater portion of the State. Their profitable cultivation is confined to the cooler and more elevated districts, which are of comparatively limited extent. On the tablelands and the cooler and moister districts, however, the Fife wheats are a very profitable crop, and in cases where they have been grown for several seasons, the milling characteristics of the grain have remained unchanged after five or six years successive cultivation.

We possess, fortunately, as the result of the work of the late Mr. Wm. Farrer, Wheat Experimentalist to the Department, a number of cross-bred wheats which have been created with the special object of providing strong-flour varieties which shall be more suitable to the local conditions than are the Fifes. Some of the most popular and successful of these crosses are described below. The Fife-Indian combinations are particularly promising ones, and are pretty certain to become extensively grown in the near future. These cross-bred wheats of Mr. Farrer's produce flour which is quite as strong as is that of the Fife wheats, and they are more suitable than those for cultivation under

our conditions, and give excellent results in the warmer districts, being good drought-resisters, and, at the same time, far less susceptible to rust than are the soft-flour wheats which have been hitherto exclusively cultivated.

Mr. Peacock, Manager of the Bathurst Experimental Farm, reports that in his district millers offer 4d. per bushel more for locally-grown Fife wheats, and 1d. per bushel more for wheats, such as Bobs, to induce farmers to cultivate them more largely. In this neighbourhood, though it is one eminently suited to the growth of strong-flour wheats, the varieties most cultivated are the weak-flour, Purple Straw type of soft wheats. Of the hard wheats, only sufficient is grown at present to satisfy local requirements. Of the new varieties, Bobs, John Brown, Cleveland, and Tarragon are grown to a limited extent, and their cutivation is increasing, especially in the higher lands of the district where they thrive well; and in the near future, Mr. Peacock reports that their cultivation will, undoubtedly, extend owing to the higher price obtainable.

Mr. Sutton, Manager of the Experimental Farm at Cowra, reports that the millers in his district offer premiums of 3d. and 4d., and as high as 6d., per bushel for Bobs wheat, for which the district is eminently suited; yields of 18 to 24 bushels per acre, and in one case of 36 bushels per acre, having been reported. These are considerably above the average for the Cowra district, which last season was 12 bushels to the acre. From all parts of the State satisfactory results are reported whenever these new varieties have been tried, and their cultivation is rapidly extending. The knowledge that there is a keen demand for this class of wheat in the English market will further stimulate their production.

The information on which the following notes are based has been obtained from various sources. For the general description of the wheats and their characteristics of growth I have drawn freely on previously published articles of the late Mr. Farrer and of Dr. N. A. Cobb (late Pathologist to the Department). I am also much indebted to Mr. R. W. Peacock, Manager of the Bathurst Experimental Farm, as well as to Mr. G. L. Sutton, Manager of the Cowra Experimental Farm, and to Mr. J. T. Pridham of the same farm.

It is by no means an easy matter to describe a typical sample of any variety of wheat, as the habit of growth changes considerably in different districts and in different seasons. At the same time, the descriptions here given have been very carefully considered, and are, it is believed, as true as possible for the different types. The descriptions have been made as short as possible, and include only the most striking characteristics.

The photographs have been specially made to illustrate the article by Mr. Burton, and show the natural size of the heads photographed; but too much importance must not be attached to the size, as this varies very considerably. Moreover, I have not, in all cases, been able to obtain average-sized heads, some being rather smaller, and some larger than the average.

The milling notes are compiled from figures obtained from samples milled in the Department's model mill, and represent, in most cases, an average taken from a considerable number of samples. The method adopted aims at the production of a "Straight-grade" flour, which is the almost universal practice amongst local millers. The wheats have been so treated as to yield at least 70 per cent. of straight-grade flour, and the notes appended will indicate whether the treatment has been unduly severe or the reverse. The actual milling has been carried out by Mr. G. W. Norris.

The figures for gluten are the percentages of gluten dried at 100° C. Those for "strength" are the number of quarts of water absorbed by a 200 lb. sack of flour to produce a dough of a suitable consistency for bread-making. To calculate the quantities required by the 280 lb. sack, these figures must be multiplied by the factor 1·4.

Steinwedel.

A very popular white, soft wheat, which originated in South Australia and is grown extensively in all the States, especially in the dry, hot districts, for which it is eminently suited on account of its resistance to drought. It is a very early, free-stooling, and prolific wheat, but it is rather delicate and liable to rust and bunt; does not want very rich land; very compact habit of growth. Its principal defect as a farmer's crop is its proclivity to shell, which is so marked that the grain shells as soon as it ripens, and unless the harvesting can be pushed on expeditiously, considerable loss inevitably results.

Characteristics of Growth.—

Stools: Abundant, large, compact, and above medium height.
Straw: Strong, stiff, hollow, medium thick, purple tinge.
Foliage: Large, drooping, weak, light green.
Ears: Bald or slightly tip-bearded, large, long, compact, uniform, white, smooth.
Spikelets: Three or four-grained, set rather irregularly round rachis.
Grain: Large, soft, white, medium plump, opaque, mealy interior

Milling Characteristics.—A very weak-flour wheat, easily milled, and yielding flour abundantly; not usually a heavy grain, though good samples have occasionally given high bushel weights. A sample of this variety gained the first prize in its class (weak-flour wheats) and champion prize for the best bag of wheat exhibited at the recent (1906) Royal Agricultural Society's Show in Sydney.

The colour of the flour is usually good, though not always reliable, having sometimes a greyish tinge. As a milling wheat it has the drawback that the flour clings to the bran, sometimes very persistently.

The gluten-content is nearly always good, sometimes very high, without affecting the colour of the flour appreciably; but the gluten is sticky

and elastic, a sign of weakness of flour. The flour from this wheat is invariably weak, and the grain is better adapted for blending with stronger flour-wheats than for milling by itself.

It is a very easy wheat to mill, and on this account, and on account of its drought-resisting qualities, still remains a strong favourite with farmers and millers, in spite of the undesirable qualities mentioned above.

A typical Steinwedel wheat gives the following figures on milling:—

Weight per bushel	63 lb.
Flour	72 per cent.
Pollard	13 ,,
Bran	13 ,,
Colour of flour	Excellent, good surface and texture.
Gluten	10 per cent.
Nature of gluten	Slightly grey, elastic, coherent.
Strength	49 quarts of water per sack (200 lb.).
Semolina	Slightly yellow tinge and soft.

Notes.—Bran, large and fairly clean. Pollard, fairly clean. Flour clings to bran. Break-flour, 25 per cent.

Farmers' Friend.

A favourite Purple Straw variety of Australian origin, and derived from the old Red Straw. A strong-stooling, drought-resisting, very prolific, early, mid-season wheat, holding its grain well (does not shell). Does fairly well even on poor land, but on rich soils and in moist seasons is liable to suffer severely from rust. It is unsuited to the coastal districts. Rather delicate, and liable to rust and bunt.

Characteristics of Growth.—

Stools: Abundant, above medium height, not very compact nor erect.

Straw: Dull yellow or purplish, thick, hollow, stiff, strong.

Foliage: Fairly good colour, long, abundant, drooping, not glaucous.

Ears: Bald, slightly awned, square, long, smooth, white, straight, erect, regular.

Spikelets: Three or four-grained and spreading.

Grain: Large, medium length, plump, white, opaque, mealy interior.

Milling Characteristics.—An easily milled, very attractive grain, not usually very heavy, yielding readily abundance of flour of beautiful colour. The flour is rather low in strength and gluten.

The colour of the flour produced from this grain is its strong point. In common with all the Purple Straw wheats, the colour is invariably high, and owing to this fact it is pre-eminently suited for blending with strong-flour varieties.

This grain is typical of the soft weak-flour wheats, until recently almost exclusively cultivated in New South Wales, and which are now

Steinwedel. Farmers' Friend.

giving way in suitable districts to the harder and stronger flour-wheats. The gluten is always low, and the resulting flour weak.

A typical sample of this grain would mill as follows:—

Weight per bushel	62 lb.
Flour	72 per cent.
Pollard	13 ,,
Bran	15 ,,
Colour	Excellent.
Gluten	9 per cent.
Strength	48 quarts per sack.

Notes.—Flour clings to bran. Bran and pollard not very clean. Semolina, white and soft. Break-flour, 30 per cent.

Australian Talavera.

A wheat belonging to the Lammas group. A very favourite, hardy, mid-season wheat, of medium height, free-stooling, prolific, and suitable to almost any district, as it is fairly drought-resistant and withstands cold. It is fairly resistant to rust, and is an attractive and favourite variety. A good hay-wheat; rather liable to shell.

Characteristics of Growth.—

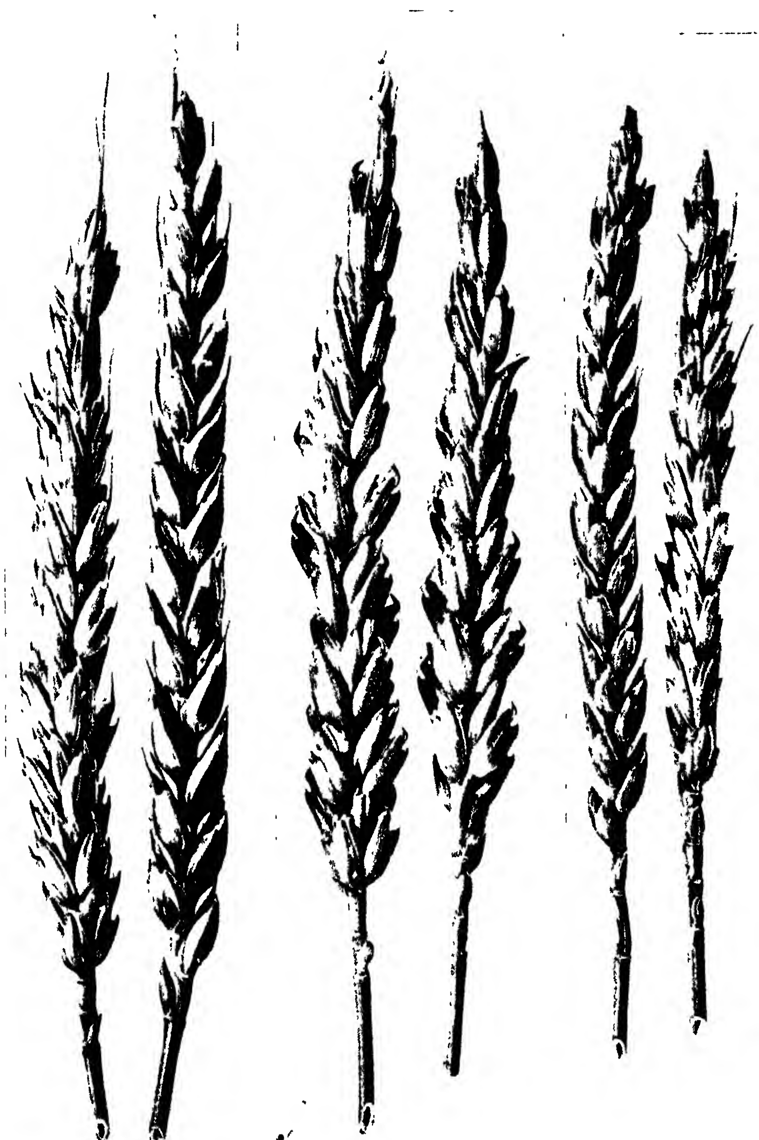
Stools: Fairly abundant, erect, rather compact.
Straw: Dull yellow, medium thick, stiff, strong
Foliage: Rather heavy, dark green colour, slightly drooping, rather glaucous.
Ears: Bald, smooth, white, long, regular, very open.
Spikelets: Two-grained.
Grain: Large, long, medium plump, opaque, white, mealy interior.

Milling Characteristics.—The grain is of good bushel-weight, and is a very satisfactory milling-wheat. It is a very easy-milling wheat, and yields readily a good percentage of first-class flour. The colour is always of the best, the gluten high, and strength good. It is one of the few wheats commonly grown which yield a flour of sufficient strength to produce a good baking flour when milled alone, and is the strongest of the soft wheats. The sèmolinas are invariably hard and gritty, a characteristic of strong-flour wheats, and the flour is sometimes as strong as some of the strong-flour varieties.

A typical sample will give the following figures on milling:—

Weight per bushel	63 lb.
Flour	73 per cent.
Pollard	10 ,,
Bran	17 ,,
Colour of flour	Excellent, yellow tinge, clear, good surface.
Gluten	11 per cent.
Nature of gluten	Fairly elastic, coherent, non-adhesive.
Strength	51 quarts per sack.

Notes.—Bran, large and clean. Pollard, clean. Semolina, slightly yellow and gritty. Break-flour, 18 per cent.



Australian Talavera. **White Lammas.** **Nonpareil.**

White Lammas.

A rather late mid-season variety of tall growth. A fairly strong-flour wheat, and one of the strongest of the older favourites. A quick grower. Rust-liable, with a tendency to shell. A free-stooling, prolific, hardy, late mid-season wheat. Suits any but coast districts; cool districts preferred. Good variety for hay.

Characteristics of Growth.—

Stools: Fairly abundant, spreading, rather creeping.

Straw: White, strong, supple, hollow, rather tall.

Foliage: Good colour, abundant, drooping, slightly glaucous.

Ears: Bald, smooth, long, regular, somewhat open, rather slender, tapering.

Spikelets: Narrow, two to three-grained, not close.

Grain: Large, long, plump, white, soft, opaque, mealy interior.

Milling Characteristics.—Generally speaking, a fairly strong-flour wheat. The grain is of taking appearance and good bushel-weight. Gluten always rather high, and of yellow colour, giving a yellow tinge to the flour, which becomes pronounced when the gluten is high. Flour yield good. The grain is an easy-milling one, the flour parting readily from the bran, which is generally plentiful, large, and flaky. Colour and texture of flour nearly always first-class and reliable, except in cases where the gluten is abnormally high.

A typical White Lammas wheat will give the following figures on milling:—

Weight per bushel	64 lb.
Flour	71 per cent.
Pollard	12 ,,
Bran	17 ,,
Colour of flour	Excellent, yellow tinge.
Gluten	11 per cent.
Nature of gluten	Yellow tinge, medium elastic, medium adhesive, medium coherent.
Strength	51 quarts per sack.

Notes.—Bran, large and clean. Pollard, clean. Semolina, yellow and slightly gritty. Break-flour, 30 per cent.

Nonpareil.

A mid-season wheat, of medium height, fairly prolific, hardy, not very rust-liable. Grown extensively, especially in South Australia. A good yielder, but not a heavy bushel-weight. Suits poor soils; not a very good drought-resister; may be sown late, and is a good hay-wheat.

Characteristics of Growth.—

Stools: Fairly abundant, spreading, fairly erect.

Straw: Strong, though rather hollow and slender, medium height to tall, fairly stiff, but firm, fairly tough, bright, clean, yellow colour.

Foliage: Fairly abundant, narrow, deep green, somewhat glaucous.

Ears: Bald, slightly tip-bearded, smooth, medium length, regular, compact, slender, tapering slightly, square, erect.

Spikelets: Three-grained.

Grain: Medium size, plump, fairly hard, opaque, mealy interior.

Milling Characteristics.—A very easy milling wheat, of fair bushel-weight, yielding readily a high proportion of flour. The flour is high in gluten and of a yellowish tinge, bright and of good surface and texture. The strength is rather low, but slightly above that of the Purple Straw type. The weak flour and the comparatively low bushel-weights are the drawbacks. Flour parts easily from bran.

A typical sample of Nonpareil will give the following numbers:—

Weight per bushel	$62\frac{1}{2}$ lb.
Flour	74 per cent.
Pollard	10 ,,
Bran	16 ,,
Colour of flour	Excellent, slightly yellow.
Gluten	12·9 per cent.
Nature of gluten	Yellow, tough, coherent, elastic, slightly adhesive.
Strength	49·2 quarts per sack.

Notes.—Very easy to mill. Bran, fairly clean. Pollard, clean. Semolina, yellowish and very slightly gritty.

White Essex.

A rather late mid-season wheat of the Lammas type, fairly prolific, free-stooling, of tall growth, bunt and rust liable, but resisting rust better than the Purple Straws, excellent for hay, giving white chaff. Prefers a fairly cool climate and not too rich a soil.

Characteristics of Growth.—

Stools: Fairly abundant, rather spreading and creeping.

Straw: Strong, tall, stout, stiff, fairly tough, hollow, white.

Ears: Bald, whitish, fairly large, long, regular, rather open, tapering, erect.

Foliage: Dark green, rather abundant, somewhat drooping.

Spikelets: Two-grained, narrow.

Grain: Large, long, soft, white, fairly plump, mealy interior.

Milling Characteristics.—A weak-flour wheat, of similar milling characteristics to the Purple Straws, though generally somewhat lower bushel-weight. It is a fairly easy-milling wheat, yielding a weak flour fairly rich in gluten, and of good colour. It is generally higher in gluten than the Farmers' Friend type of wheat, which it otherwise much resembles,

though belonging to the Lammas or Tuscan group. A typical sample will mill as follows:—

Weight per bushel	62 lb.
Flour	69 per cent.
Pollard	16 ,,
Bran	15 ,,
Colour of flour	Very good.
Gluten	11 per cent.
Strength	48 quarts per sack.

Notes.—Fair to mill. Bran, clean. Pollard, not very clean. Semolina, slightly yellow, and very slightly gritty. Break-flour, 20·9 per cent.

Zealand.

One of the best hay-wheats we possess; is another of the Lammas group of wheats. A quick grower. Both late and early; should be sown early. Does not stool very freely, and is liable to rust. Resists drought fairly well, and is suited for the dry country. Shells slightly. It is an excellent hay-wheat, having a long, weak, white straw.

Characteristics of Growth.—

Stools: Fairly abundant, medium height, rather spreading, not very erect.

Straw: Long, flexible, fairly strong, hollow, medium thick, and fairly uniform.

Foliage: Light colour, rather abundant, drooping.

Ears: Bald, very large, long, regular, open, very tapering.

Spikelets: Two-grained, narrow.

Grain: Long, plump, very large, opaque, white.

Milling Characteristics.—A weak-flour wheat, of fair bushel-weight, generally rich in gluten, and of excellent colour. A typical Zealand wheat will give the following figures:—

Weight per bushel	62 lb.
Flour	72 per cent.
Pollard . .	15 ,,
Bran . .	13 ,,
Colour of flour . ..	Very good, good texture.
Gluten	12 per cent.
Nature of gluten .	Inelastic, non-coherent, medium adhesive.
Strength	48 quarts per sack.

Notes.—Very easy to mill. Bran and pollard, clean. Semolina, slight, yellow, and soft. Break-flour, 30 per cent.

Dart's Imperial.

A similar grain to Nonpareil, and a great favourite in South Australia and Victoria, originating from grain selected by Mr. Dart, of South Australia. It is of the Purple Straw type, and rather later than most of this type. It is rust-liable, but resists drought well, and does well in hot climates, stooling freely, and giving good yields both of hay and grain. A good hay-wheat. Of medium height and compact habit of growth.

White Essex.

Zealand.

Characteristics of Growth.—

Stools: Fairly abundant, compact, erect.
Straw: Stiff, tall, hollow, strong, stout.
Foliage: Medium green, abundant, drooping, not glaucous.
Ears: Tip-bearded, rather large, medium length, uniform, clubbed at tip.
Spikelets: Two to three-grained, fairly close.
Grain: Medium size, plump, white, soft, mealy interior.

Milling Characteristics.—An excellent milling wheat of the weak-flour type; generally fairly rich in gluten. Easy to mill, yielding readily a high proportion of flour of the best baking quality, except in strength, in which it is usually somewhat low. Typical milling samples will give:—

Weight per bushel	62 lb.
Flour	72 per cent.
Pollard	14 ,,
Bran	14 ,,
Colour of flour	Excellent, good surface and texture.
Gluten	11 per cent.
Nature of gluten . ..	Yellow, soft, coherent, and elastic.
Strength	48 quarts per sack.

Notes.—Bran, clean and large. Pollard, clean. Semolina, white and soft. Break-flour, 30·9 per cent.

White Hogan.

One of the later varieties. Fairly prolific. Does not resist drought well; prefers cool climate. Rather rust and bunt liable. Tendency to shell. An excellent hay-wheat, with long, fairly strong straw.

Characteristics of Growth.—

Stools: Fairly abundant, rather spreading.
Straw: Stiff, hollow, white, tall, fairly strong.
Foliage: Medium green, fairly abundant, rather drooping.
Ears: Bald, white, fairly large, rather long, tapering.
Grain: Large, long, fairly plump, white, soft, mealy interior.

Milling Characteristics.—An easy-milling wheat, of good appearance and weight, yielding flour of good colour and fair gluten-content, but very weak. This is one of the weakest flours, and the straight-grade flour is not a good baking flour unless blended with stronger ones. Typical milling figures:—

Weight per bushel . .	62 lb.
Flour	71 per cent.
Pollard	16 ,,
Bran . . .	13 ,,
Colour of flour	Very good, yellowish, good surface and texture.
Gluten	10 per cent.
Strength	47 quarts per sack.

Notes.—Easy to mill. Bran and pollard, clean. Semolina, white and rather gritty. Break-flour, 22 per cent.

Dart's Imperial. White Hogan. Marshall's No. 3.

Marshall's No. 3.

A variety originating with Mr. Marshall, the South Australian wheat-grower. Derived from Ward's Prolific, on which wheat it is an improvement, both in gluten-content and strength. A great favourite in South Australia and Queensland, and extensively grown in New South Wales. It is especially suited for the Northern districts of the State. It is rust-resistant—a characteristic of Ward's Prolific—and its cultivation is stated to have saved the South Australian wheat harvest in one very rusty season. A late mid-season wheat; fairly prolific; fairly good drought-resister, but does best in the cooler districts. Has a tendency to make too much leaf. A good hay-wheat.

Characteristics of Growth.—

Stools: Fairly abundant, somewhat spreading and creeping.
Straw: Rather stiff, hollow, strong, fairly tall.
Foliage: Dark green, rather abundant, rather drooping.
Ears: White, slightly tip-bearded, fairly large and long, uniform and compact.
Grain: White, plump, medium size, medium soft, mealy interior.

Milling Characteristics.—A first-rate and easy-milling wheat, good bushel-weight, yielding abundant flour readily. Flour of excellent baking quality, being of first-rate colour, fairly high strength, and invariably rich in gluten. A typical sample of Marshall's No. 3 gives the following figures in the mill:—

Weight per bushel ..	63 lb.
Flour . .	73 per cent.
Pollard	13 ,,
Bran	14 ,,
Colour of flour .. .	Excellent, good surface and texture.
Gluten . .	12·5 per cent.
Nature of gluten . ..	Slightly yellow, elastic, coherent, medium adhesive.
Strength	51 quarts per sack.

Notes.—Easy to mill. Bran and pollard, clean. Semolina, white and rather gritty. Break-flour, 22 per cent.

Field Marshal.

Another of Mr. Marshall's varieties; a cross between Improved Fife and Marshall's Prolific. It has lost the strong-flour characteristics of the Fife wheats, and is a weak-flour variety. Not much grown in New South Wales. A mid-season wheat; rust and bunt liable.

Characteristics of Growth.—

Stools: Moderate, rather compact and erect.
Straw: Fairly strong, hollow.
Foliage: Light colour, not very abundant, fairly erect, not glaucous.
Ears: Amber, slightly tip-bearded, fair size and length.
Spikelets: Two to three-grained, regular, fairly close.
Grain: White, slightly translucent, fairly hard, medium size, plump, rather horny interior.

Milling Characteristics.—An easy-milling, attractive-looking grain, giving flour of good quality and rich in gluten, but of rather low strength. Average milling character of the few samples milled is as follows:—

Weight per bushel ..	61 lb.
Flour	71 per cent.
Pollard .	10 ,,
Bran	19 ,,
Colour of flour .	Excellent.
Gluten	13 per cent.
Strength	48 quarts per sack.

Notes.—Easy to mill. Bran, fairly clean. Pollard, clean. Semolina, slightly yellow and soft. Break-flour, 30·5 per cent.

Mr. Farrer's Cross-bred Wheats.

A. Improved Soft, Weak-flour Wheats.

Federation.

A cross between Purple Straw and Mr. Farrer's Fife-Indian wheats (of which latter Jonathan is typical). This is one of the Purple Straw crosses designed as improvements on the original strain, particularly in the matter of flour strength. It is one of the most successful of these crosses, being a favourite both with farmers and millers. It is an early-ripening, drought-resisting variety, very prolific, and holds its grain well. Suits all districts of the State except the cool and coast districts, and is especially suited to warm districts, and prefers fairly rich soil. It is not rust-resistant, and is inferior for hay, as the straw, though of good quality, is short.

Characteristics of Growth.—

Stools: Fairly abundant, compact, erect.

Straw: Stiff, hollow, fairly strong, short.

Foliage: Medium green, fairly abundant, broad, fairly erect, not glaucous.

Ears: Bald, brown, medium to large, medium length, uniform, compact, square.

Spikelets: Two to three-grained, rather close.

Grain: White, soft, plump, large.

Milling Characteristics.—An attractive grain, of good bushel-weight, milling easily and similarly to the Purple Straws. The flour is much higher in strength and gluten than the Purple Straws, and the straight-grade flour is a first-rate baker's flour. A typical sample of Federation gives the following figures on milling:—

Weight per bushel	62 lb.
Flour . .	71 per cent.
Pollard .	14·5 ,,
Bran	14·5 ,,
Colour of flour	Excellent, yellowish tinge.
Gluten	12 per cent.
Nature of gluten .. .	Yellowish, elastic, coherent, not adhesive.
Strength	52 quarts per sack.

Notes.—Easy to mill. Bran, large and clean. Pollard, clean. Semolina, white and soft. Break-flour, 25·8 per cent.

Jade.

A cross between Jacinth (of Purple Straw descent) and Early Baart. It is extremely liable to rust. It is a fairly early wheat, rather earlier than Purple Straw; is a heavy cropper, and does not shell. It withstands drought well, and is a hardy wheat, giving good results on poor soil and in dry districts. It is a good hay-wheat.

Characteristics of Growth.—

Stools: Medium, rather erect, compact.
Straw: Hollow, fairly stiff, rather strong.
Foliage: Rather light colour, abundant, somewhat drooping.
Ears: Rather large, fairly long, bald, white.
Spikelets: Two-grained, close.
Grain: White, large, plump, fairly hard.

Milling Characteristics.—A very easy-milling wheat, of fair and often high bushel-weight. Yields flour very freely. The flour, though of fair strength and gluten-content, is not of the best baking quality, being inclined to starchiness. A typical sample will give the following figures:—

Weight per bushel	64 lb.
Flour	72 per cent.
Pollard	13 ,,
Bran	15 ,,
Colour of flour	Very good, rather starchy, excellent surface and texture.
Gluten	10 per cent.
Nature of gluten	Medium coherent and adhesive.
Strength	49 quarts per sack.

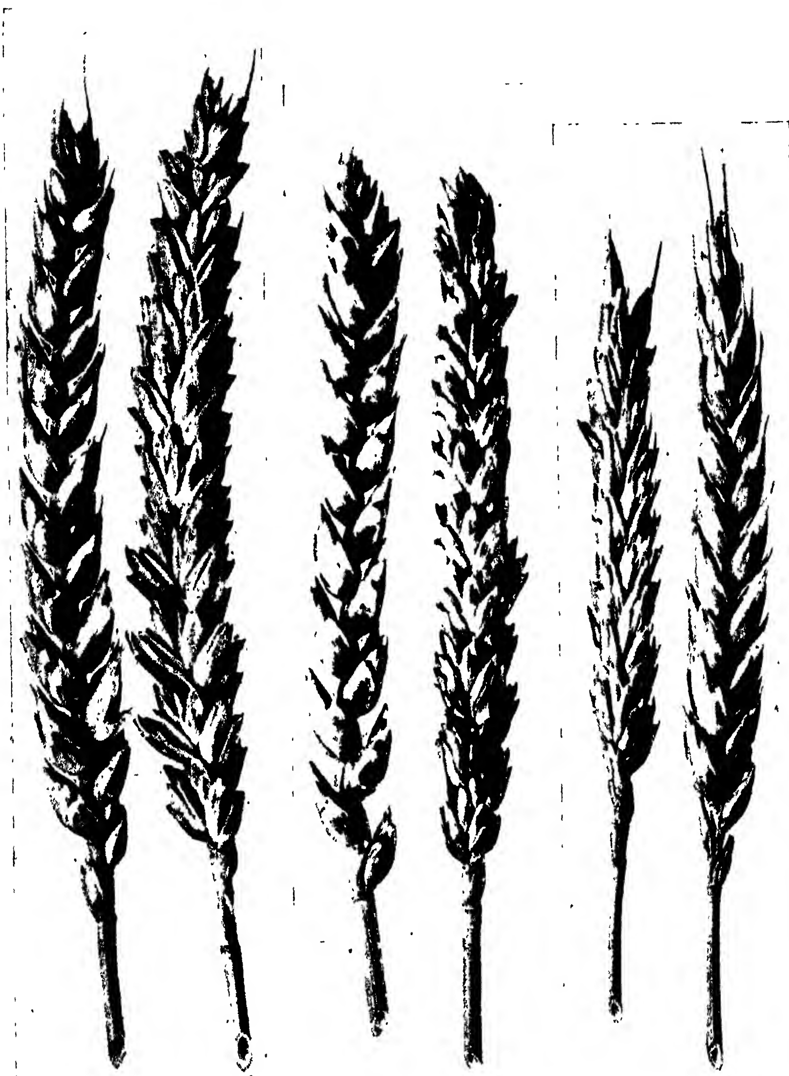
Notes.—Easy to mill. Bran and pollard, very clean. Flour parts easily. Semolina, white and very slightly gritty. Break-flour, 30·5 per cent.

Cumberland.

Also a Purple Straw cross, and becoming a strong favourite with farmers on account of its quick growth and prolificness. It is also a good hay-crop. It does well in hot, dry climates, and resembles Steinwedel in its drought-resisting quality. It is unlike Steinwedel in that it holds its grain well, but is a soft, weak-flour wheat. It is an early variety, of a compact habit of growth.

Characteristics of Growth.—

Stools: Rather scanty, compact, erect.
Straw: Rather stiff, tall, hollow, rather strong.
Foliage: Dark green, fairly abundant, rather compact, drooping, slightly glaucous.
Ears: White, rather large, tip-bearded, medium length, uniform.
Spikelets: Three to four-grained, spreading.
Grain: White, soft, opaque, rather small.



Field Marshal. Federation. Jade.

Milling Characteristics.—A weak-flour wheat, easy to mill; flour of good colour and gluten-content; high percentage of good bran. Typical milling figures:—

Weight per bushel	62 lb.
Flour	72 per cent.
Pollard	12 ,,
Bran	16 ,,
Colour of flour	Excellent.
Gluten	11 per cent.
Strength	47 quarts per sack.

Notes.--Easy to mill. Bran, clean and large and flaky. Pollard, fairly clean. Semolina, white and soft. Break-flour, 17 per cent.

Cleveland.

Another cross between soft, weak-flour wheats and hard wheats, its parents being Fife wheat and Blount's Lambrigg with Purple Straw Tuscan. A late variety, suitable to the highlands and coastal districts. Rather prolific, and fairly resistant to drought. It also resists rust well, and is not very susceptible to bunt.

Characteristics of Growth.—

Stools: Abundant, spreading.

Straw: White, stiff, tall, hollow, fairly strong.

Foliage: Dark green, rather abundant, rather stiff and narrow, glaucous.

Ears: Bald, tip-bearded, not large, fairly long, tapering, white.

Spikelets: Two to three-grained.

Grain: Rather long, fairly plump, hard, translucent, horny interior.

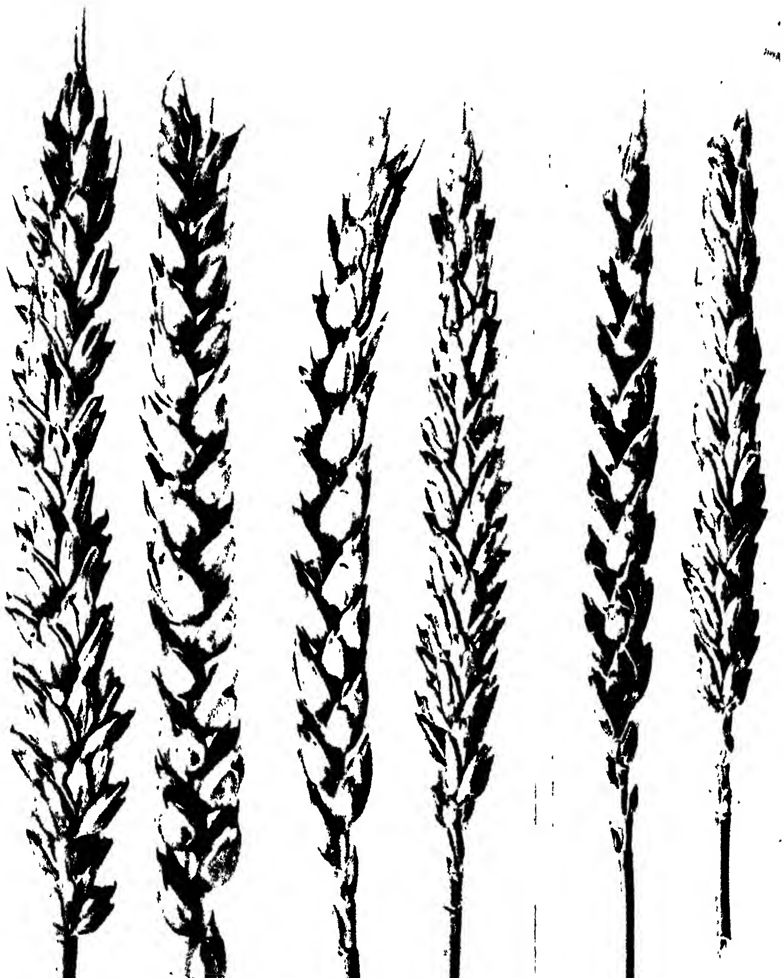
Milling Characteristics.—A fairly easy-milling wheat, yielding first-class baking flour of high colour, fairly strong, and rich in gluten. Yield of bran very high. Typical milling figures:—

Weight per bushel	62 lb.
Flour	72 per cent.
Pollard	11 ,,
Bran	17 ,,
Colour of flour	Excellent.
Gluten	13 per cent.
Strength	51 quarts per sack.

Notes.—Easy to mill. Bran and pollard, clean. Semolina, slightly yellow and gritty. Break-flour, 22 per cent.

Rymer.

The parents of this variety are Improved Fife and Purple Straw. It is also one of the improved weak-flour varieties, but has hardly proved as successful, so far, as some of the others. It is rather a delicate wheat, and though fairly rust-resisting, suffers from the wheat aphis, which



Cumberland. Cleveland. Rymer.

breaks down the straw. It is, consequently, better suited to the cooler districts where this pest does not exist. It is also subject to bunt. It is a mid-season variety, and makes good hay. It resists drought fairly well, but it is not at its best in very dry districts nor in very rich soil. Its flour is somewhat like that obtained from Federation, but less strong and glutinous.

Characteristics of Growth.—

Stools: Not heavy, fairly compact, erect.
Straw: Not very stiff, somewhat slender, hollow, white, medium height.
Foliage: Medium green, scanty, erect, stiff and narrow, somewhat glaucous.
Ears: White, medium size and length, slightly tapering.
Spikelets: Two to three-grained, slightly translucent.
Grain: White, fairly plump, medium size, medium hard.

Milling Characteristics.—A nice-looking, bright grain, of good bushel-weight, yielding fairly freely flour of first-rate colour, good strength, and fairly high in gluten. Typical milling results:—

Weight per bushel	62 lb.
Flour	70 per cent.
Pollard	14 ,,
Bran	16 ,,
Colour of flour	Excellent, good surface.
Gluten	10 per cent.
Strength	50 quarts per sack.

Notes.—Fairly easy to mill. Bran and pollard, fairly clean. Semolina, slightly yellow and slightly gritty. Break-flour, 27 per cent.

Plover.

A cross-bred wheat, containing three-quarters Purple Straw blood with a little Fife and Ward's Prolific. It is therefore an improved Purple Straw, possessing a greater power to resist rust, and yielding a stronger flour than the last-named variety. It is particularly suited to the warm and fairly warm districts. A good yielder, more prolific than Purple Straw, and is a good wheat for hay, having good and long straw. It resists drought fairly well.

Characteristics of Growth.—

Stools: Rather scanty, fairly compact, erect.
Straw: Fairly stiff and strong, hollow, rather stout, tall.
Foliage: Colour fairly good, fairly abundant, slightly drooping, fairly glaucous.
Ears: Slightly tip-bearded, fairly uniform, medium length, rather large.
Spikelets: Three to four-grained, rather spreading.
Grain: Bright yellow, plump, large, and fairly hard.

Milling Characteristics.—The weak point about this flour is the colour, which is generally low and prevents its being milled into straight-grade

flour, otherwise it is a good-milling wheat, of heavy bushel-weight (some samples have exceeded 65 lb. per bushel), yielding readily a high percentage of flour of good strength and fairly rich in gluten. Typical milling:—

Weight per bushel .	63 lb.
Flour .. .	73 per cent.
Pollard	12 ,,
Bran .	15 ,,
Colour of flour	Fair, rather dark.
Gluten .	10 per cent.
Strength ..	52 quarts per sack.

Notes.—Easy to mill. Bran and pollard, clean. Semolina, faint yellow and slightly gritty. Break-flour, 25 per cent.

Schneider.

A wheat of the same parentage as Plover, and possessing the same milling character. It is an early variety, prolific, and suitable to the dry warm districts, as it resists drought well. It is a fairly good wheat for hay. Its defects are its propensity to shell and its liability to rust and bunt.

Characteristics of Growth.—

Stools: Moderate, fairly compact, rather erect.
Straw: Rather stiff, hollow, strong, fairly tall.
Foliage: Colour fairly good, rather abundant, rather drooping.
Ears: Similar to Steinwedel, slight amber tint, tip-bearded, rather large, not compact.
Spikelets: Three to four-grained.
Grain: White, fair size, plump, soft, mealy.

B. Strong-flour Cross-bred Wheats.

Bobs.

The result of a cross between a sport from Blount's Lambrigg (one of the Defiance group) and Bald Skinless Barley (Nepaul Barley). This wheat is amongst the most successful of Mr. Farrer's wheats, and is becoming a great favourite with both farmers and millers, on account of its resistance to rust and its high flour-strength. In many country mills a higher price per bushel is offered, and the prejudice existing against it at first, on account of the hardness of its grain, is fast disappearing.

It is generally regarded as a hardy, rust-resistant variety, and has escaped rust in rusty seasons when the wheats in neighbouring paddocks were destroyed with it. Some growers have, however, latterly reported it to be susceptible to rust. It is a quick grower and good cropper, and is a good drought-resister, having been reported from several districts as

having done better than any other during a drought. It thrives best in moderately cool climates, and on soil that is not too rich. It is susceptible to frosting if sown too early. It has also a slight tendency to shell. It is liable to infection by bunt, and the grain should be pickled before being sown. It is of tall growth, having long, fine straw, and is a good variety for hay.

Characteristics of Growth.—

Stools: Not abundant, compact, erect.
Straw: Rather tall, white, hollow, fairly strong, not very stout.
Foliage: Dark green, not heavy, erect, stiff, glaucous.
Ears: Bald, fair size, long, white, very open.
Spikelets: Two to three-grained, open.
Grain: Small, plump, white, hard, translucent.

Milling Characteristics.—It is a splendid milling wheat, giving a good proportion of strong flour, quite as strong as the Fife wheats. A strong-flour wheat of high bushel-weight; some samples have gone over 65 lb. A hard wheat, and objected to by some millers for this reason, just as the Fife wheats are objected to. It resembles these wheats very strongly in its behaviour in the mill, and, if properly conditioned, yields its flour readily and in good quantity. Produces a straight-grade flour of high baking quality, being of high colour, good gluten-content, and very strong.

A typical, well-grown sample of Bobs wheat gives the following figures on milling:—

Weight per bushel	63 lb
Flour	70 per cent.
Pollard	15·5 ,,
Bran	14·5 ,,
Colour of flour	Excellent, slightly yellow, good surface and texture.
Gluten	11 per cent.
Nature of gluten	Slightly yellow, coherent, elastic.
Strength	54 quarts per sack.

Notes.—Fairly easy to mill. Bran and pollard, clean. Semolina, yellow and gritty. Break-flour, 17 per cent.

Fife-Indian Wheats

These are wheats produced by the late Mr. Farrer by crossing the well-known Fife wheats, such as are grown in Manitoba and Duluth, with selected Indian varieties. The special defects, from an Australian standpoint, of the Fife wheats are their lateness and their liability to shell. These are counteracted by the earliness and ability to hold their grain firmly which characterise the Indian wheats; while the weakness of straw, which is a defect of the Indian wheats, is overcome by the infusion of Fife blood.

The Fife-Indians differ as a class from the Fifes in being earlier, in holding their grain more firmly, and, in a less degree, in having straw which is slenderer, shorter, and produced in less abundance.

Plover. Schneider. Bobs.

Jonathan.

This is the result of crossing several strains of Fife with Indian wheats (the Fife blood predominating), and is one of the most successful and popular of Mr. Farrer's "Fife-Indian" wheats. It is rust-resistant, and, like Bobs, has entirely escaped this disease in rusty seasons when adjacent paddocks have been devastated. It has very fine, rather weak, and fairly long straw. It is a quick grower and a good cropper, holds its grain well, and resists drought. Hard to thresh. It is a good hay-wheat, and suits any district in the State, doing best in moderately cool climates. It is a very strong-flour wheat.

Characteristics of Growth.—

Stools: Rather sparing, compact, erect.

Straw: White, medium height, rather supple, hollow, fairly strong, rather slender.

Foliage: Good colour, rather sparse, erect, stiff, narrow, glaucous.

Ears: Bald, white, not large, medium length, tapering.

Spikelets: Two-grained, sharp, pointed, and closely adherent.

Grains: Small, plump, white, hard, translucent.

Milling Characteristics.—A first-rate milling wheat, of excellent appearance and high bushel-weight. The grain is hard, but yields readily a good proportion of flour. Flour of first-rate colour, high gluten-content, and very high strength. One sample of flour milled from this grain absorbed 68 quarts of water to the 200 lb. sack. The flour-strength is frequently as high as 60.

Milling of a typical sample of Jonathan gives the following figures:—

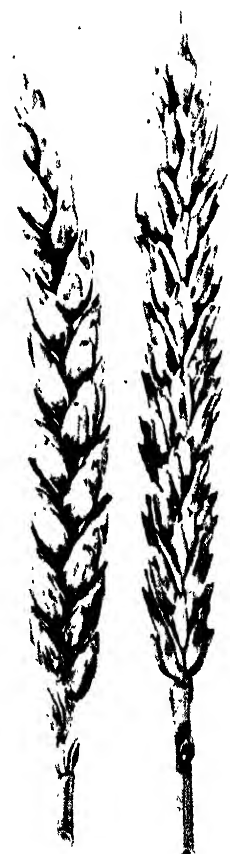
Weight per bushel	63 lb.
Flour	71 per cent.
Pollard	14 ,,
Bran	15 ,,
Colour of flour	Excellent, slightly yellow.
Gluten	13 per cent.
Nature of gluten	Yellow, elastic, fairly coherent, non-adhesive.
Strength	56 quarts per sack.

Notes.—Bran, clean and small. Pollard, clean. Semolina, yellowish and gritty. Break-flour, 16 per cent.

John Brown.

A cross containing blood of two Fife wheats and Australian Talavera, amongst others. A strong-flour wheat, resisting rust, and a heavy and reliable cropper, holding its grain well. It is especially suited to the warm and fairly warm districts, and is fairly drought-resistant. It also does well in the cooler districts, but is predisposed to frosting. It is a mid-season wheat. Straw of good quality and rather tall. A good wheat for hay. The grain is rather liable to bunt, and requires pickling.

Jonathan.



John Brown.

Characteristics of Growth.—

Stools: Fairly abundant, compact, fairly erect.

Straw: Rather tall, white, stiff, hollow, strong, stout.

Foliage: Fairly good colour, fairly abundant, erect, rather stiff, glaucous.

Ears: Bald, brown, medium size, fairly long, fairly compact, somewhat tapering.

Spikelets: Two to three-grained.

Grain: White, medium hard, fair size, plump, opaque.

Milling Characteristics.—An attractive grain and excellent milling wheat, giving a flour rich in gluten and of good strength and colour. A typical sample of John Brown gives the following figures on milling:—

Weight per bushel	61 lb.
Flour	70 per cent.
Pollard	15 ,,
Bran	15 ,,
Colour of flour	Excellent.
Gluten	12 per cent.
Strength	51 quarts per sack.

Notes.--Bran and pollard, fairly clean. Semolina, white and slightly gritty. Break-flour, 20 per cent.

Tarragon.

A cross between Tardent's Blue and Improved Fife with Australian Talavera. Tardent's Blue is a variety which was introduced into Queensland some years ago from the Lower Danube, and is a popular wheat with Queensland farmers.

Tarragon is a strong-flour rust-resisting variety. It is a heavy cropper and a good milling wheat, and also good for hay. It is rather a late variety, and is particularly suited for the highlands and the cooler and moister districts. Not very resistant to drought. Resists rust and bunt rather well. Rather weak straw.

Characteristics of Growth.—

Stools: Rather abundant, spreading, rather creeping.

Straw: White, rather tall, fairly stiff, not very stout, hollow.

Foliage: Dark green, fairly abundant, erect, narrow, stiff, glaucous.

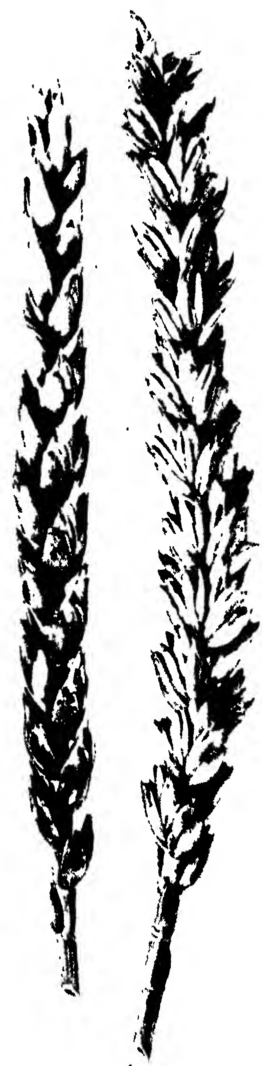
Ears: Slightly tip-bearded, white, not large, medium length, tapering.

Spikelets: Two to three-grained, not very compact.

Grain: White, medium hard, medium size, fairly plump.

Milling Characteristics.—A fair milling wheat, yielding a very high proportion of flour without detriment to the colour, which is very good. Flour of high strength, and very rich in gluten. A first-rate wheat for the miller.

Tarragon.



Power's Fife.

A typical sample of Tarragon will mill as follows:—

Weight per bushel	$62\frac{1}{2}$ lb.
Flour	78 per cent.
Pollard	13 ,,
Bran	9 ,,
Colour of Flour...	Excellent, rather yellow.
Gluten	13 per cent.
Strength	53 quarts per sack.

Notes.—Bran and pollard, very clean indeed. Semolina, yellow and slightly gritty. Break-flour, 6 per cent.

Fife Wheats.

These wheats were practically unknown to New South Wales farmers until a few years (about ten years) ago, when failure in the local harvest, owing to drought, compelled the millers to import flour and grain from Manitoba and Duluth. The superiority of the flour produced from this class of wheat was at once apparent, and it is becoming a popular crop in many districts. Many millers offer as much as 4d. per bushel more for this wheat locally grown than for the ordinary soft wheats, with which they mix it for the sake of improving the strength of their flour.

The grain locally grown for several years in succession does not appear to deteriorate appreciably in respect to its most valuable characteristic (the production of flour with high strength), whilst the colour of the flour improves when grown under local conditions.

As a farmers' crop the Fife wheats have the defects that they are late in coming to maturity, they are not drought-resistant, and are affected by hot winds, and they do not hold their grain well, being liable to shell during ripening or harvesting. Successful cultivation is practically confined to the cooler climates of the State.

Power's Fife.

A prolific late-season variety, resisting rust and bunt, and suitable to cool and moist climates. It does not do well in the hot and dry districts as it possesses no drought-resistance. In dry seasons it yields poorly, and its grain is liable to be badly pinched. It has a tendency to shell. It is a good hay-wheat in the cool districts.

Characteristics of Growth.—

Stools: Abundant, spreading, creeping.
Straw: White, tall, fairly stiff, hollow, not very strong, slender.
Foliage: Colour very good, abundant, erect, rather stiff, glaucous.
Ears: Bald, white, not very large, medium length, tapering, glabrous, chaff rather thin and delicate.
Spikelets: Three to four grains, rather open so that grain shows when ripe.
Grain: Bright red, small, plump, hard.

Milling Characteristics.—Power's Fife is an excellent milling wheat of the strong-flour type. On milling, it yields a good proportion of strong flour, very rich in gluten. The colour is excellent; but the straight-grade

Cretan.

Beloturka.

flour of this variety has occasionally a slight pink tinge. A typical grain of this variety will give the following figures on milling:—

Weight per bushel	63 lb.
Flour	72 per cent.
Pollard	14 ,,
Bran	14 ,,
Colour of flour	Very good.
Gluten	13 per cent.
Strength	56 quarts per sack.

Notes.—Bran and pollard, very clean. Semolina, yellowish and gritty. Break-flour, 19 per cent.

Macaroni Wheats.

These wheats have been grown locally for many years, and on account of their drought-resisting properties and their faculty for producing good crops in districts where the rainfall is too low for the ordinary bread-wheats they have been grown fairly extensively as a fodder or hay crop. Recently attention has been drawn to their possible value as milling wheats, and the late Mr. Farrer obtained a quantity of seed of the varieties used for bread-making in Southern Russia and Algeria, with the object of testing their adaptability to our own conditions. The wheats here described are the progeny of this importation, grown on a large scale at the Experimental Farms, and represent the first extensive harvest of these wheats. Consequently, data concerning their milling quality is meagre, and the figures given must be received with caution. They show, however, on the whole, certain definite characteristics, which may be stated as follows:—

They are all bearded wheats, particularly suited to the arid districts on account of their resistance to drought. They are also rust and bunt resistant. They are not very prolific, require heavy seeding, and stool sparingly. Being bearded, they are not suitable for hay, and are difficult to thresh.

The grain is nearly always very hard and flinty, of medium size, long, and translucent, with horny interior; the flour generally fairly strong, rich in gluten, and of rather low colour. The result of their growth under local conditions would appear to be a modification in certain directions, notably a diminution in their gluten-content and an improvement in the colour of their flour.

Owing to the flinty nature of the grain, and the consequent modification in the milling process, rendered necessary by the comparative difficulty of milling them satisfactorily, they are not likely to become very popular with our millers, who are accustomed to produce a straight-grade flour from soft, easy-milling wheats.

They require more conditioning than is usually given and produce very little break-flour. The bran is, as a rule, very small and clean.

Kubanka. Velvet Don. Farrer's Durum.

Cretan.

A good drought-resisting wheat; said to mature its grain in seasons when bread-wheats have failed, and is particularly suited for the hot arid districts of this State. It is a late variety, and resists both rust and bunt. It is only fairly prolific, and requires heavy seeding. It is not suitable for hay. The fact of it being heavily bearded makes it objectionable both for hay and for threshing.

Characteristics of Growth.—

Stools: Scanty, rather spreading, erect.
Straw: White, tall, supple, strong, slender.
Foliage: Colour fairly good, sparse, stiff, fleshy, semi-solid, erect, narrow, glaucous.
Ears: Bearded, golden brown, uniform.
Spikelets: Two-grained, close-lying.
Grain: Long, translucent, medium size, hard, flinty, horny interior.

A typical sample will mill as follows:—

Weight per bushel	61 lb.
Flour	70 per cent.
Pollard	15 ,,
Bran	15 ,,
Colour of flour	Yellow, rather better than the other macaroni wheats.
Gluten	15·5 per cent.
Nature of gluten	Bright yellow, slightly elastic, coherent and adhesive.
Strength	52 quarts per sack.

Notes.—Rather difficult to mill. Bran, very clean and small. Pollard, very clean. Semolina, yellow and gritty. Break-flour, 7 per cent.

Beloturka.

From Southern Europe; tall habit of growth; very similar to Cretan in its general characteristics.

Characteristics of Growth.—

Straw: Dull yellow, semi-solid, medium thick, strong, flexible.
Foliage: Scanty, drooping.
Ears: Bearded, compact, regular, strongly flattened.
Spikelets: Two to three-grained.
Grain: Large, long, medium, plump, translucent, yellowish or amber, horny interior.

A hardy, prolific, rust-resistant, mid-season variety; matures quickly. A typical grain of this variety gives the following figures in the mill:—

Weight per bushel	62 lb.
Flour	71 per cent.
Pollard	17 ,,
Bran	12 ,,
Colour of flour	Yellow, rather dark.
Gluten	14 per cent.
Nature of gluten	Bright yellow, elastic, very coherent.
Strength	52 quarts per sack.

Notes.—Rather difficult to mill. Bran, very clean, small, but large for the type. Pollard, fairly clean. Semolina, yellow and very gritty. Break-flour, 7 per cent.

Kubanka.

One of the best of these wheats, and probably the one most adapted for the production of straight-grade flour. In general character of growth, &c., it closely resembles Cretan, having broader and flatter heads. Grain very hard and flinty, medium size, yellowish, translucent, horny interior. The following were the figures obtained in milling a good sample of this grain:—

Weight per bushel	62 lb.
Flour	72 per cent.
Pollard	19 ,,
Bran	9 ,,
Colour of flour	Yellow, rather dark.
Gluten	15 per cent.
Nature of gluten	Bright yellow, elastic, slightly coherent, slightly adhesive.
Strength	54 quarts per sack.

Notes.—Rather difficult to mill. Bran, very clean and small. Pollard, very clean. Semolina, yellow and very gritty. Break-flour, 7 per cent.

Velvet Don.

Very similar in manner of growth to Cretan. Heads are broader, and spikelets not quite so closely set.

Weight per bushel	61 lb.
Flour	69 per cent.
Pollard	16 ,,
Bran	15 ,,
Colour of flour	Yellow, rather dark.
Gluten	15 per cent.
Strength	57 quarts per sack.

Notes.—Bran and pollard, fairly clean. Semolina, yellowish and gritty. Break-flour, 15 per cent. Fair to mill, rather easier than the others, but it will be seen that the offal was not so well cleaned. Velvety chaff.

Farrer's Durum.

A Durum wheat grown and selected by Mr. Farrer for many seasons. Indicates probable loss of strength in this particular grain if grown long under local conditions.

Weight per bushel	63 lb.
Flour	69 per cent.
Pollard	16 ,,
Bran	15 ,,
Colour of flour	Good, yellow, rather dark.
Gluten	14 per cent.
Nature of gluten	Very soft, yellow, and adhesive.
Strength	48 quarts per sack.

Notes.—Difficult to mill. Bran and pollard, very clean. Semolina, yellow, and very gritty and hard. Flour, heavy.

Rhodes Grass.

(*Chloris Gayana*, Kunth.).

J. H. MAIDEN,
Government Botanist and Director of the Botanic Gardens, Sydney.

I WISH to draw attention to a valuable grass, which in Australia has come to be known as Rhodes Grass. The name Rhodes Grass is not known in Natal, and in the Transvaal the grass (*Chloris virgata*) that we style

Rhodes Grass grown at Wollongbar Experimental Farm, Richmond River.

Rhodes Grass is known as "Sweet Grass," while the one that they know as Rhodes Grass is *Chloris Gayana.*

Furthermore, as I shall show by means of the illustrations, the "Rhodes Grass" that we most commonly grow in New South Wales does not precisely match the description of either *virgata* or *Gayana;* but a certain amount of variation is obviously unavoidable in grasses under cultivation.

So that we are in a bit of a fix. Let our nurserymen sell seeds or plants under the name of Rhodes Grass if they choose (it is really Sweet or Zoet Grass), but let them drop the name *Chloris virgata* for it. If they wish to employ a botanical name, let them call it *Chloris Gayana,* for it is nearer to that species.

The error, or rather errors, have had a very good start; but my advice is, when you find you are on the wrong road, endeavour to retrace your steps. The responsibility rests with those who first used the name without having it critically examined. As far as I am concerned, I used the names "*Chloris virgata,* Rhodes Grass," for nearly a couple of years, because I was informed that they had been given with scientific authority. The error was also observed by Mr. Chomley, the sub-editor of the *Gazette.*

The following correspondence is interesting:—

Botanic Gardens, Sydney,
30th January, 1906.

There are three grasses that go under the name of Rhodes Grass, viz.:—

(*a*) *Chloris Gayana,* Kunth.
(*b*) *Chloris virgata,* Swartz.
(*c*) *Chloris virgata,* Swartz, var. *elegans,* Stapf.

They differ from each other in certain botanical characters, but they are closely allied, and it is probable that their economic value is much the same. Their general appearance is more like each other than the *Transvaal Agricultural Journal* plates would seem to indicate.

(*a*) *C. Gayana,* Kunth.

Figured in "Natal Plants" (Grasses), Medley Wood, Vol. V, Part 2.

In *Transvaal Agricultural Journal,* October, 1905, Plate 8 gives "Rhodes Grass" (*C. Gayana*), "A valuable perennial grass for hay and pasturage."

In *Agricultural Journal of Cape of Good Hope,* Vol. XXI, *C. Gayana* is called "Rhodes Grass." In the same journal, Vol. XXIII, *C. virgata,* var. *elegans,* is also termed "Rhodes Grass," while in Vol. XXIV of the same journal, *C. virgata* is termed "Rhodes Grass." And bear in mind that the Cape of Good Hope (not the Transvaal) was Rhodes' home. *C. virgata* is also called "Rhodes Grass" in the United States Department of Agriculture, Bureau Plant Industry, Bulletin 66.

C. virgata has a more compact head of spikes than has *C. Gayana.*

C. Gayana has "Spikes, six to fifteen, rarely spreading, whitish-greenish or brownish, 2½ to 4 inches long, rhachis scabrid" (Medley Wood).

Also occurs in tropical Africa.

(*b*) *C. virgata,* Swartz.

Figured in "Natal Plants" (Grasses), Medley Wood, Vol. V, Part 2.

In *Transvaal Agricultural Journal,* October, 1905, we have, Plate 9, "Sweet Grass or Zoet Grass" (*C. virgata*), "An annual grass* commonly found on old maize lands, and highly esteemed for hay." See also following passage:—"The favourite Veldt Hay is that composed of 'Sweet (Zoet) Grass' (*Chloris virgata*). This is said to be keenly relished by stock, and to be a nutritious fodder."—*Transvaal Agricultural Journal,* January, 1905, page 290.

"Spikes, six to fifteen or more, whitish-green or purplish, 1 to 2½ inches long, straight; rhachis pubescent or villous at the base, scabrid."

Found in the tropics of both hemispheres.

* Doubtful whether perennial.—J.H.M

(c) *Chloris virgata*, Swartz, var. *elegans*, Stapf.

This is called "Rhodes Grass" in the *Cape Agricultural Journal*, Vol. XXIII, page 239 (September, 1903).

"Spikes up to 3 inches long."

Kindly send me authenticated specimens of these three grasses and criticise my statement.

J. H. MAIDEN,
Director.

J. Medley Wood, Esq., A.L.S.,
Botanic Gardens, Berea, Durban,
Natal.

Durban, Natal,
20th March, 1906.

I have received your letter about the species of *Chloris*, but am afraid that I can give but little information about them; the popular name, Rhodes Grass, is not known here—in fact, very few of our grasses have any popular names, and our farmers seem to know but little about them, or do not care to give the information. I send by same post specimens of *C. Gayana*, Kunth., and *C. virgata*, Swartz. The variety *elegans* I do not know, and it is not in our herbarium. My number for it, as given in the Flora Capensis, is incorrect, being an Ochna. I have two specimens named by Hackel *C. elegans*, but these are both *C. virgata*, typical, and have been so certified at Kew. These three grasses are all annual, and are frequently found about old Kaffir gardens. I do not think that any attention is given to them in Natal as fodder grasses, but I will make further inquiry about them, and write you again if I get more information.

J. MEDLEY WOOD,
Director of the Botanic Gardens.

I wrote a similar letter to Mr. J. Burtt Davy, Botanist to the Department of Agriculture at Pretoria, but, owing to that gentleman's absence from headquarters so much, I have not had a full reply.

In the *Transvaal Agricultural Journal* for October, 1905, Mr. J. Burtt Davy figures (*a*) "Rhodes Grass (*Chloris Gayana*)—A valuable perennial grass for hay and summer pasturage"; and (*b*) "Sweet Grass or Zoet Grass (*Chloris virgata*)—An annual grass commonly found on old maize lands, and highly esteemed for hay."

In Medley Wood's "Natal Plants" (Grasses), he figures Plates 436 and 437 respectively *C. virgata* and *C. Gayana*. The descriptions are given herewith, and part of the illustrations.

Chloris virgata, Swartz. (Fl. Cap., Vol. VII, p. 641.)

Perennial or annual (flowering the first year), 1 to 3 feet high.—Culms erect or geniculately-ascending or prostrate below, rooting and emitting fascicles of barren shoots from the nodes—three to five-noded—more or less compressed below, glabrous, smooth, internodes exserted; sheaths glabrous, rarely sparingly hairy, smooth, the lower much compressed, keeled; ligules membranous, very short, very minutely ciliolate; blades linear, gradually tapering to an acute point, 1 to 4 inches by 1 to 1¾ line, flat or folded, sometimes flaccid, glaucous, glabrous, rarely sparingly hairy, smooth below, scaberulous above, margins rough; spikes, six to fifteen or more, sub-erect, sessile, whitish-green or purplish, 1 to 2½ inches long, straight; rhachis pubescent or villous at the base, scabrid.

Spikelets two- (rarely sub-three) flowered, two-awned, almost 2 lines long; rhachilla joint between the valves rather long, terminal joint very minute.

Glumes narrow, lanceolate, hyaline, mucronate; keels scabrid, the *lower* 1 to 1¼ line long, the *upper* almost 2 lines; lower valve obliquely oblong, acute or obscurely two-toothed, 1½ line long, whitish or almost black when mature, ciliate along the marginal nerves and bearded below the tip, finely grooved on the faces, keel glabrous or minutely ciliate below the middle; awn 5 to 8 lines long, straight; pale glabrous; anthers ⅐ to ¼ line long; grain linear-oblong, obtusely triquetrous, ¾ line long; upper valve (or valves) quite empty, obliquely cuneate in profile, 1 line or less long; awn from below the tip 3 to 6 lines long.

PLATE 436

CHLORIS VIRGATA, Swartz.

(AFTER MEDLEY WOOD)

CHLORIS GAYANA, Kunth

(AFTER MEDLEY WOOD)

PLATE 437

Var. *elegans* (Stapf). Spikes up to 3 inches long. Spikelets usually sub-three-flowered; lower valve conspicuously gibbous, 1¼ line long, more deeply grooved on the faces; keel glabrous or ciliate to and bearded at the middle. *Habitat.*—Natal, Berea, *Wood*, 5,948; river banks at Tugela, 600 to 1,000 feet alt., *Buchanan*, 186; Van Reenen's Pass, 5,500 feet alt., *Wood*, 5,990; Zululand, 2,000 feet alt., *Jenkinson*, 52; var. *elegans*, Inanda, 1,800 feet alt., *Wood*, 687. Widely spread through the tropics of both hemispheres.

Mr. Jenkinson says of this grass:—"Found chiefly in old cultivated ground; dries up altogether in winter. It is said to be a good fodder grass, and to be much relished by stock." Dr. Andrew Smith says that the natives boil the roots to make a bath for colds, and also for rheumatism.

Fig. 1, lower glume; 2, upper glume; 3, valve in profile; 4, pale; 5, pistil, stamens, and lodicules; 6, second valve. All *enlarged.*

Chloris Gayana, Kunth. (Fl. Cap., Vol. VII, p. 642.)

Perennial or annual, 2 to 4 feet high. Culms erect or geniculately-ascending or prostrate at the base, simple or branched, often emitting fascicles of barren shoots or short runners from the lowest nodes, often robust, three to nine-noded, compressed below, glabrous, smooth, *upper* internodes usually exserted; sheaths glabrous or sparingly hairy near the mouth, smooth, the *lower* strongly compressed, keeled; keels sometimes scabrid, the uppermost sometimes tumid; ligules membranous, very short, long-hairy; blades linear, long-tapering to a fine point, ½ to more than 1 foot by 3 to 4 lines when expanded, flat or folded, glabrous or hirsute near the base, green, smooth below, rough above and on the margins: spikes, six to fifteen, umbelled, sessile, sub-erect, rarely spreading, 2½ to 4 inches long, greenish or brownish; rhachis scabrid.

. Spikelets 1½ line long, three-four-flowered, shortly two-awned.

Glumes very unequal, the *lower* ovate-lanceolate, acute, subhyaline, ½ to ¾ line long, the *upper* oblong, obtuse, mucronate, 1 to 1½ line long, firmer, scaberulous; lowest valve oblong, subobtuse or acute, minutely two-toothed, ciliolate along the marginal nerves, and shortly-bearded below the tips or only finely bearded (in the South African species), or almost glabrous, with a sometimes minutely hairy groove on each face; awn as long or slightly longer than the valve, straight; callus minutely bearded; pale glabrous; keels scabrid; anthers ¾ line long, second valve with a male flower, like the preceding, but glabrous, 1 line long; awn 1 line long or less; third (and fourth) valve rudimentary, cuneate in profile, empty, awnless.

Habitat.—Natal, Umlazi River, *Drège*; Umaduana, *Sutherland*; near Durban, *Williamson*, 43; Umpumulo, *Buchanan*, 188. Also in tropical Africa.

Drawn from Buchanan's 188.

Fig. 1, lower glume; 2, upper glume; 3, valve; 4, pale; 5, pistil, stamens, and lodicules; 6, second valve; 7, rudimentary valve. All *enlarged.*

Following is a report by Mr. Fairchild, Agricultural Explorer to the Department of Agriculture of the United States:—

9,608. *Chloris virgata* (Rhodes Grass).

From Capetown, South Africa. Received through Messrs. Lathrop and Fairchild (No. 1,131, 8th March, 1903), 6th May, 1903:—"A species of pasture grass that, although scattered widely through the tropics of both hemispheres (according to the books), has probably not before been brought into culture. Mr. Cecil Rhodes had the seed of this plant collected several years ago and sown in large patches on his place, near Capetown, called 'Groote Schur.' The grass has done well there, forming heavy sods of a good herbage, and the manager of Mr. Rhodes' farm has had the seed collected and distributed among the planters of the colony, by whom it is called 'Rhodes Grass.' From what I saw of these patches on the slopes of a hillside, I do not believe this is a drought-resistant form—at least, it is not able to withstand very severe dry weather. It has the typical finger-like inflorescence of the genus and its strong, tough, creeping stems lie flat on the ground. When given sufficient moisture the grass is said to produce a mass of forage over 2 feet high; but what it would do if subjected to severe drought has yet to be found out. I saw a single patch which had been sown with the seed and had failed to take, and it was evident that the drought-resisting powers of the plant are quite limited. However, a grass which has attracted the attention of so

keen a cultivator as Mr. Rhodes, and is meeting with favourable comment from many practical men here at the Cape, deserves a thorough trial in America. As the species is a perennial it need only be tested in frostless or nearly frostless regions. Its fodder value will be much inferior to alfalfa (lucerne), but it will thrive on soil with little lime in it. This seed was given Mr. Lathrop for distribution in America by the steward of Mr. Rhodes' estate, and, in case it succeeds, the Chartered South African Company, at Capetown, should be notified of the success it attains."—United States Department of Agriculture, Bureau Plant Industry, Bulletin 66.

See also:—

(*a*) "The season for sowing the two pasture grasses, the one known locally as Rhodes Grass (*Chloris Gayana*), and *Paspalum dilatatum*, is now with us," writes a correspondent. "Rhodes Grass does well if sown in September. It may be sown either broadcast, or in a nursery and the roots planted out afterwards. Sown in September, on the slopes of Table Mountain, I have seen the ground thickly covered with this vigorous-growing grass three months afterwards. Sown later, on dry ground, on the Cape Flats, I have seen it entirely fail. Both Rhodes Grass and *Paspalum dilatatum* are summer growers. In parts of the colony where the summer is very dry, they can only be expected to yield a good return of fodder when either watered or in a locality where there is a subsoil moisture. Thus, though Rhodes Grass may fail on dry ground on the Cape Flats, it will succeed on vlei ground." "Rhodes Grass, as our correspondent calls it, has done very well indeed on many parts of the Cape Flats."—*Agricultural Journal of the Cape of Good Hope*, Vol. XXI, July-December, 1902.

(*b*) *Rhodes Grass in Australia.*

"Rhodes Grass (*Chloris virgata*, Sw., var. *elegans*) is apparently attracting attention in New South Wales in consequence of its drought-resisting properties. The *Pastoralists' Review* says:—'Mr. R. H. Dangar, of Neotsfield, Whittingham, New South Wales, has been experimenting with a hardy South African grass, called "Rhodes Grass," with results that are most interesting. This plant was considered highly valuable by the late Mr. Cecil Rhodes, and Mr. Dangar has proved that its claims as a drought-resisting grass are quite just. The seed, which was imported from South Africa by Mr. Sylvester Browne, was sown in November, 1902. Single roots were transplanted in the following December, and a photograph taken on 5th April, 1903, shows a splendid growth of the grass at five months old. Those five months were particularly dry, therefore the growth made by the Rhodes Grass should certainly point to its being a plant worthy of further experiment in any country subject to drought. Stock eat this grass readily, and seed is being sent to Mooki Springs Station for experiment there.'"—*Agricultural Journal of the Cape of Good Hope*, Vol. XXIII, July-December, 1903.

(*c*) *Rhodes Grass.*

"The Director of the Sydney Botanic Gardens, writing in December, says that the seed of the Rhodes Grass (*Chloris virgata*) received from this Department readily germinated. He also obtained some roots, and they now have the grass well established. It appears to promise well as a cattle grass for New South Wales."—*Agricultural Journal of the Cape of Good Hope*, Vol. XXIV, January-June, 1904.

There is no doubt that to Mr. Sylvester Browne, of Minembah, Whittingham, near Singleton, belongs the credit of first introducing this grass into New South Wales. He was not content with bringing it over, but he gave seeds of it to me and others at an early date, and he raised a most vigorous plot of it on his property, which I saw and much admired.

He also well introduced it into many parts of Australia, by selling large quantities of it under the name of *Chloris abyssinica*.

The Singleton district is, of course, not a place of high rainfall, and it is rather cold in winter.

RHODES GRASS (GROWN IN NEW SOUTH WALES)

In an acre-paddock adjoining the Lutheran Church at Grafton is a most remarkable display of Rhodes Grass, grown by Mr. H. A. Volckers, of that city. An illustration, from a photograph sent by that gentleman, is reproduced. I can only say that it would be difficult to imagine a finer stand of grass, which, when I saw it, was 3 feet 6 inches to 4 feet high.

Rhodes Grass grown by Mr. H. A. Volckers, Grafton, New Sou h Wales.

Now, the virtues of the Rhodes Grass appear to me to be as follows :—

1. It smothers Nut Grass.
2. It is a good grass for green feed.
3. It is an excellent grass for hay.
4. It is a rapid grower.
5. It has fibrous roots, so it is not likely to be a nuisance, since it can readily be eradicated if required.
6. The seeds germinate readily.
7. It runs 6 or 8 feet and then grows erect.
8. It is very palatable to stock.

If it has any vices, I do not know of them. In any case, I believe its good points far outweigh its possible bad ones, and, therefore, I recommend experiments with it in many parts of the State. Acclimatisation experiments are undoubtedly full of surprises, and I believe that Rhodes Grass—a grass of great vitality—will be found to flourish in many districts where at present it is untried. The seed is very cheap.

EXPLANATION OF PLATES.

Chloris virgata, Swartz (after Medley Wood). } See explanation above.
Chloris Gayana, Kunth. (after Medley Wood). }
Rhodes Grass (grown in New South Wales). This is *C. Gayan*, var.
Flowering tops of the grass (reduced in size).
1. Spike with persistent outer glumes (flowering glumes dropped).
2. Flowering glumes, each with a palea, and with the produced rhachis between them.

Water Hyacinth in New South Wales.

Report of Committee appointed to inspect areas on the Northern Rivers affected by this Pest, and to make Recommendations.

In accordance with the wishes of the Minister for Public Works, we were appointed a committee to inspect the areas affected by Water Hyacinth on the Northern Rivers, and to make recommendations in the matter. We now have the honor to submit our report on the subject.

We left Sydney on the 18th June for Brisbane, where we consulted a number of persons who are conversant with the spread of the pest in Queensland waters. We then proceeded to the Tweed, Richmond, and Clarence Rivers; Swan Creek, South Grafton, being the most southern locality visited. In returning to the Tweed we varied our route somewhat, and from various centres short detours were made to inspect various affected areas.

Some of the Localities Visited.

The following are some of the places visited on this trip, and may be considered as fairly characteristic of the Water Hyacinth growth in this State:—

Clarence River District.—Swan Creek, South Grafton, and Ulmarra; Fisher Park, Grafton; Alumny Creek, Grafton.

Richmond River District.—Between Casino and Coraki, south of river, various lagoons and creeks; Sandy and Bungawalbin Creeks; Terania Creek, above Lismore; Maori and Byron Creeks, near Binna Burra; Tuckombil Creek, near Woodburn; Emigrant Creek, near Tintenbar.

Tweed River District.—Lavender Creek and lagoons in vicinity of Murwillumbah; lagoon near Rowland's Creek, above Byangum.

Clarence River District.

Swan Creek, South Grafton, 4 miles from ferry, is a very bad place, and a centre of infection for the lagoons in this district.

Fisher Park, Grafton, which is referred to in the letter of the Mayor, herewith.

Alumny Creek, Grafton to Southgate.—This is what may be termed a notorious locality, having already cost the Government a large sum of money for eradication, and then having been permitted to get bad again.

Richmond River District.

There is plenty of Water Hyacinth in the lagoons and creeks adjacent to the Richmond River. For example, at Mr. James Campbell's, Codrington, 4½ miles from Coraki on the Casino-road, we have a large lagoon ¾ to 1 mile in length, 300 feet wide, a dense growth containing millions

of Water Hyacinth plants; at 5½ miles from Coraki on the same road, at Mr. Henry Pidcock's, and westerly of this owner's property, there are numbers of lagoons containing the plant in large areas; also at Green's selection, on a branch of Deep Creek, the Water Hyacinth is well established; and these areas are, in flood-time, connected with the south arm of the river. There is also an abundance of the plant in the Horseshoe Lagoon, 2½ miles from Casino.

These instances might be multiplied almost indefinitely.

Emigrant Creek.—On the road from Tintenbar to Binna Burra, 3 miles from the former, in Emigrant Creek, at portion 54, parish of Teven, we observed Water Hyacinth to be very abundant. We doubt whether floods will eradicate this growth in a place like this. It is protected by *Arundo phragmites* and other reedy growths. The creek at this place is a rapidly-running stream, but the plant collects in the bends and covers large areas. As we stood we saw plants being detached and washed down-stream. This is a most interesting locality, as many people are inclined to believe that Water Hyacinth is only found in sluggish streams or stagnant water.

TWEED RIVER DISTRICT.

Lavender Creek.—We find that at this creek the municipality of Murwillumbah nearly eradicated the growth, and the flood has cleared the remainder; but a few dormant plants remain, and it will spread again if not checked, as the swamps—which are the sources of supply to this creek—are still full of it.

Byangum.—The growth in the lagoon near Rowland's Creek above Byangum is reported to have been entirely destroyed by pigs having been turned on to it. They quickly eat the hyacinth out.

QUEENSLAND.

At the Bremer River, near Ipswich, the pest is more prolific than on any of the coastal rivers of this State. From the upper reaches of this river, during floods and freshets, large areas of many acres in extent are discharged into the main Brisbane River, where they threaten interference with navigation and damage to the large bridges near Brisbane, by collecting flood debris above these structures. These floating masses have to be divided, and by means of tug-boats taken clear of the bridge piers and floated seawards.

Within the past four months a navigable reach of the Bremer River has been thoroughly choked for a distance of 2 miles by Water Hyacinth brought down and deposited in what had hitherto been a clear stream.

History of the Plant in New South Wales.

It is stated that the first Water Hyacinth on the Northern Rivers was purchased from a nurseryman at Brisbane as a pretty plant, and thrown into the Swan Creek, South Grafton, by a local resident, when he tired of it.

Mr. H. A. Volckers, a well-known nurseryman of Grafton, states that *Nymphæa stellata,* a beautiful blue-flowered water lily, used to exist in the greatest abundance at Swan Creek, and was a pretty sight, and he sent tubers of it from this creek twenty-three years ago to the Botanic Gardens, Sydney. The Water Hyacinth then came and destroyed the *N. stellata* completely—"wiped it out." It appears that the Water Hyacinth was first looked upon as a possible pest about ten years ago.

One of us, bearing in mind the pest the plant is to river navigation in Florida, U.S., wrote a paper in the *Agricultural Gazette* of New South Wales for 1897, p. 698, entitled "The Water Hyacinth, or *Pontederia* (*Eichhornia*) *crassipes,* as a Possible Pest." This warning was emphasised later by the late Mr. J. Stephenson in the same periodical for 1899, p. 1140, with which were reproduced two illustrations showing the hindrance to navigation the plant is in Florida waters.

In the same periodical for 1900, p. 787, is an article on the spread of this plant, containing two most instructive photographs, showing the state of Swan Creek, Grafton, as regards Water Hyacinth growth in 1898 and in 1900. (We reproduce these.)

In the *Agricultural Gazette* for 1900, p. 446, another article appeared, with which was an excellent photograph of a living plant from the Botanic Gardens. (We reproduce this.)

There are some articles containing a number of details and miscellaneous information on the Water Hyacinth in the *Queensland Agricultural Journal,* which it seems unnecessary to repeat here.

Endeavours have also been made to stimulate public interest against this pest by means of the newspapers and correspondence with a large number of people.

Spread of the Pest.

One method of spreading the plant is by means of cattle and horses, which, coming to the lagoons and creeks to drink, tread the growth into the banks of the creek or bed of the lagoon, and firmly root them. Plants also loosened by cattle, &c., are then carried both up and down stream in tidal waters, to form fresh beds at their next lodgment. The plant is not a pest in waters with a swift current, or having a liability to scour. It is found in Queensland that a current of 4 miles an hour is rapid enough to carry the growth away into salt water, which destroys it. It chiefly becomes a pest in lagoons, where it tends to become perpetual.

At the same time, we have given an instance at Tintenbar of the plant being found in the bends of a rapid-running stream.

The plant is also spread by the detachment caused by the current; such plants are increased by offsets (vegetatively), and also reproduced by seeds. There is also little doubt that the propagation is carried on through birds, such as the wild duck, diver, crane, red-bill, pelican, &c., carrying the seed from one district to another; otherwise the appearance of the plant in localities where no other means of transportation can be suspected is

unaccountable. The plant tends to suck up all the water in shallow creeks and lagoons, converting limpid streams into bogs.

Beware of its Appearance in Clean Country.

So far as we know, the Water Hyacinth has not yet made its appearance on the Macleay River, but there is no reason why it should not. The spread of the plants at its outposts should be carefully watched, as it is a fact abundantly ascertained that plants generally acclimatise themselves to new conditions. It will grow on the Macleay River at the present time (it grows in Sydney, but does not flourish); but, assuming for sake of argument, that it will not get out of hand there at once—which we dare not assume in practice—there is no doubt that in a few years a race of Water Hyacinths will be bred which will stand a considerable degree of cold, and which will be as much at home on the Macleay as is the present race on the Richmond and Tweed.

The Water Hyacinth has been found in fairly large growth in the Wollundry Lagoon (about 15 acres), near Wagga, and about 7½ acres (or half) of this water area was covered with the growth. The plants were removed by men in boats, in 1900, at a cost of £8, or about £1 per acre. The growth was introduced to this place by some people living close to the lagoon about the year 1895. (See Appendix 3.)

We view this position as one of great seriousness, as the proximity of such a pest to the long lengths of sluggish fresh-water rivers of the western slopes, such as the Murray, Murrumbidgee, and the Darling Rivers, constitutes an element of danger. Here the natural conditions are favourable to the extensive growth of the plant, and if it once obtains a hold would be much more troublesome and costly to cope with than is ever likely to be the case in the short coastal districts of the State.

We are informed that in Queensland the plant has a considerable hold in the western rivers of that State, and is now giving a good deal of trouble in blocking the waterways there. It is also a great pest in lagoons in the Rockhampton district.

Fodder Value of the Plant.

We heard many statements that cattle and pigs eat this plant, and one of our number gives the following analysis of a sample, showing it to possess a fair feeding value:—

Water	90·17	per cent.
Ash	1·42	,,
Fibre	1·33	,,
Albuminoids	1·75	,,
Sugar and other Carbo-hydrates ...	5·10	,,
Ether extract (fat or oil)	0·23	,,
	100·00	,,
Nutritive value	7·36	,,
Albuminoid ratio	1 to 3·2	,,

The amount of indigestible fibrous matter is much lower than one would be led to expect from the appearance of the leaf and stem. It is a succulent and attractive plant, and contains apparently no injurious properties, so that it is not surprising to hear that it is eaten by stock of all kinds (horses, cattle, and pigs). In composition it is not unlike succulent roots, such as turnips, mangels, &c.; consequently, while not for an instant regarding this as a fodder plant, the fact that it has a definite feeding value must be taken into account when dealing with its eradication.

Legislation regarding Weed Pests, and General Remarks.

As regards noxious weeds legislation, we believe that it has sometimes proved abortive, because of the nature of the weeds to be coped with. We, therefore, think, that no weed should be inserted in the Schedule of any "Noxious Weeds Act" except on expert advice, especially as many worthy people have the most childlike faith in the efficacy of a "Weeds Act" against weeds of every class. It is also noteworthy that after a period of years certain weeds disappear as suddenly as they came, the conditions of development, may be of germination of the seed, are unfavourable at a critical period or periods, and death results.

The Water Hyacinth is a weed of a special character; it is a large tangible weed, which is mainly propagated by floods and running streams. It is formidable by reason of its abundance, and it is not likely that it will ever be entirely exterminated from New South Wales. Nevertheless, we are of opinion that if stringent and early steps be taken the pest can be so kept under control that it will cease to be a nuisance. We are just as firmly of opinion that if it be allowed to spread unchecked it will seriously diminish the value of land in many parts of the Northern Rivers, as well as cause great expense in the near future in clearing what are now open navigable streams, for the use of vessels now trading without difficulty on such waters. We believe that the same arguments, which are rightly deemed to be valid by the Health Authorities, for the compulsory notification and stamping out of certain diseases affecting human life and domestic animals, are in their degree equally valid as regards certain noxious weeds. It is time that the policy of "*laissez faire*" should be abandoned as regards some of our weeds.

We conversed with large numbers of locally interested people, and found that most of them are viewing the spread of the pest with alarm. It is, however, recognised that no satisfactory steps can be taken, except under the operation of a law. If one man clears his property his neighbour may, by neglecting his land, thereby infect the whole locality.

Shires and Municipal Councils might be empowered to administer the Act within their boundaries, and deal with the growth existing on Crown land (or water) within such areas. For the first removal of the plants some assistance might be given to such bodies, not to exceed 12s. 6d. per acre, the price for each locality being fixed by an officer of the Department, according to the denseness of the growth, &c. The maximum

amount above quoted would cover a moiety of the cost of removal, the balance being a charge on the shire or municipal funds, but in view of the plant being of some value as a fodder the amount suggested should be an adequate assistance in its removal.

After the rivers, lagoons, or watercourses had once been cleared of the growth, it should be the duty of such governing bodies as those indicated to keep the plant in check within their boundaries at their own cost. Some of the areas on private lands are of considerable size; but bearing in mind that the analysis of the plant proves that the Water Hyacinth has some fodder value, it is not recommended that any help be given to remove the growth from private lands.

Methods of Eradication.

Two methods of destruction have been adopted in this and other countries in dealing with this pest—one by spraying with a chemical solution, and the other by various chemical means, as hereafter noted. We are of opinion that there is no practical chemical method of destroying the pest, and we consider that mechanical methods will require to be employed.

Chemical means.

The use of poison in dealing with a growth of this kind, especially where most of it is found in the fresh-water lagoons and creeks on private land, would be fraught with too much risk to animal life. Cattle, horses, birds, and fish, also vegetation, would all be likely to be affected by any poisonous solution which would be sufficiently strong to kill the Water Hyacinth.

Mr. W. A. Smith, M. Inst. C.E., of the Public Works Department, has been making some private experiments with a solution of sulphate of copper, of a strength of 1 to 500,000, which is the strongest solution that any fish life have been known to live in, while trout would not live in any stronger solution than 1 in 7,000,000. Mr. Smith states that he has not found any effect on the plant yet (after thirty days) from the stronger solution above mentioned.

The "Harvesta Compound," which was used to some extent on the St. John's River, is reputed to contain arsenic; but in view of the scanty information obtainable as to the results of the use of this compound, especially as regards animal life, we cannot recommend its adoption.

Mechanical methods.

By the courtesy of Mr. E. A. Cullen, Engineer for Harbours and Rivers, Queensland, the following information has been obtained as to the methods adopted in the Northern State in dealing with this plant:—The area to be dealt with is first enclosed by floating timber booms to prevent the loosened plants being carried up or down by tidal action. A floating coir rope,

with bamboo floats a few feet apart, is then run out from one bank in the form of a horseshoe (just as a fishing-net is "shot"), the two ends of the line being brought to within 100 feet of each other on the one bank; the material is then hauled close into the bank by this means, and afterwards lifted out by men with pitchforks on to the bank, where it is left to dry, and afterwards burnt in some instances. Where the banks are high, or otherwise unsuitable for this method, 20-ton punts are used, the means adopted being similar to that above described.

We were also informed that on one of the northern rivers of Queensland a punt, with a flap set a little below the water's edge, is hauled into the area, and the plant is then raked on to an endless travelling band, which carries the plant up to rollers which crush it, and it is then passed by the same means into a barge, or on to the shore, where it is used as a manure. We consider it inadvisable to recommend its use as a manure. It should be burnt if possible.

Cost of both methods compared.

The method of spraying with a poisonous compound known in the United States, America, as the "Harvesta Compound," is done by means of barges fitted with sprays and pumps; but this method, the cost of which is about £4 per acre, when compared with the mechanical means adopted in Queensland, that costs from 20s. to 30s. per acre, is out of the question. The same remarks apply to spraying with other substances.

It is, therefore, considered that, apart from the question as to the deleterious effect of poison on fish or other animal life, the removal of the plant by mechanical means would be the most economical that can be adopted.

One area of particularly dense growth, containing 56 acres, situated on the Bremer River, has recently been removed at a cost of £84—or 30s. per acre.

The areas on Crown land in this State, and which the Government would be called upon to deal with, are at the present time comparatively small, owing to recent floods or freshets having cleared most of the tidal creeks of the growth, and if the work of clearing is to be continued it would cost very much less to have it done now than later on; but some uniform action between the property-owners and the State is imperative, and until this is made legally possible, much of the work done now would be of little use in itself as a check to the growth in the Northern River districts.

It is also suggested that when the work is undertaken it should be carried out by contract, if tenders can be obtained at a reasonable rate, as the local people, by utilising their spare time, could tender at a less cost than the work (in many places of small and scattered areas) could be carried out by the Department.

Conclusions and Recommendations.

1. We recommend that a Noxious Weeds Bill be submitted to Parliament.
2. That such Bill contain a Schedule empowering such and such a plant to be declared a noxious weed.
3. That the Water Hyacinth be proclaimed a noxious weed.
4. That the act of bringing the Water Hyacinth into New South Wales, of planting it, throwing or placing it in any lagoon or watercourse, of encouraging its spread, of trafficking in it, be made a punishable offence.
5. That every landowner be compelled at his own cost to destroy all the Water Hyacinth growth on his property, and in the creeks and lagoons abutting thereon, within a period of (say) two years from the passing of the Act.
6. That certain areas in which the pest has obtained a very firm footing be scheduled, and assistance may be given from the public funds towards the eradication of the plant.
7. Provision should be made for adequate patrol, with a view of preventing its recurrence.

J. H. MAIDEN,
Government Botanist.

F. B. GUTHRIE,
Chemist, Department of Mines and Agriculture.

T. E. BURROWS,
Assistant Engineer, Department of Public Works.

APPENDICES.

1. Letter from the Mayor of Grafton, showing that the Municipal Council there is impressed with the seriousness of the pest.
2. Map showing the localities on the Northern Rivers where the Water Hyacinth may be found in fairly large areas. (Not reproduced.)
3. Letter from Council Clerk, Wagga Wagga, giving particulars of growth in Wollundry Lagoon.
4. Extract from *Agricultural Bulletin*, Straits Settlements, April, 1906.
5. Illustrations from *Agricultural Gazette*, 1900, p. 787, showing Swan Creek, near Grafton.
6. Photograph of a Water Hyacinth plant, *Agricultural Gazette*, 1900, p. 446.
7. Photograph showing denseness of growth of water hyacinth at Port Darwin. (Not reproduced.)

Appendix No. 1.

Water Hyacinths on the Clarence.

In accordance with a promise made to Mr. J. H. Maiden, of the Botanic Gardens, Sydney, the Grafton Borough Council considered the matter of exterminating the Water Hyacinths from the watercourses on the Clarence. The Council referred the question to a sub-committee, who duly gave it consideration. They found that the hyacinths were introduced as a novelty to the district some ten years ago, and were planted in one of the wide reaches of the Swan Creek, about 2 miles from its entrance to the Clarence River. The hyacinth has a pretty blue flower, and this was the attraction that caused its introduction. Very soon it was evident that a nuisance was brought to the district, and in due course the pest spread to various waterholes and creeks. It took possession of Alumny Creek, that intersects the city of Grafton, and there are creeks at Ulmarra and other parishes that have become thoroughly choked with the nuisance. So far it is not known to have any value, although stock eat it, but not greedily. It is a soft growth, not unlike cress or other aquatic growths, and grows though detached from the beds or banks of the watercourses. It occasionally drifts in masses into the navigable water of the river, but does not appear to menace the navigation, as is reported in the American lakes. It does not flourish in salt water. During the winter months it receives a severe cutting up with frost, and at the present time (July) the foliage and flowers are destroyed. It speedily recovers in spring, and soon makes up for the lost time it experienced in winter. Some years ago the Government cleared the growths from Alumny Creek, and partially from Swan Creek, but the action was not continuous, and from lack of funds, and need also of proper legislation, the hyacinths soon restored themselves to the watercourses from whence they had been taken. To remove them would be a costly matter, and from a small hole of less than half an acre, in Fisher Park, Grafton, the lowest tender for a single clearing was £7 10s. When they are reduced by the winter frost would be the best time for exterminating by removal. The committee appointed by the Council are of opinion that the most effective manner to deal with the pest is to proclaim it a noxious weed or growth, and compel owners on the frontages to keep it down, or in check. It is asserted by some that it grows from bulbs, others from seed; but there is no denying the fact that no matter how it is propagated, it is a remarkably fast grower, like all other noxious vegetation. It spreads as it floats on the water, drifting about from place to place, and the spread in this way alone is rapid. After a flood, when the hyacinth has been lifted *en masse* from the watercourses, and distributed over the dry land where it is deposited by the receding waters, would be a suitable time for its annihilation. It would then be but a matter of preventing its reappearance, and the enormous cost of removal would be saved. It need hardly be stated that it will not grow on dry land, under any conditions.

Signed on behalf of the Council,

D. McFARLANE,

Mayor.

Swan Creek, near Grafton, in 1898.

Appendix 5.

Swan Creek, near Grafton, in 1900.

Appendix 6.

WATER HYACINTH PLANT

Appendix No. 3.

Sir, Borough of Wagga Wagga, 31 July, 1906.

In reply to your inquiry of the 25th instant, I beg to state as follows :—

1. The Water Hyacinth was introduced into the Wollundry Lagoon, Wagga Wagga, by some people living close to the lagoon, about the year 1895.
2. By 1900 the plant had multiplied so rapidly that it appeared likely to cover the whole surface.
3. The area of the lagoon is, approximately, 15 acres, and about half this area became covered.
4. The plants were removed by means of men and boats, in 1900, the cost being £8.

I have, &c.,

R. EMBLEN,
Council Clerk.

The Director, Botanic Gardens, Sydney.

Appendix No. 4.

The Water Hyacinth (Eichornia crassipes).

April, 1906.

THIS beautiful aquatic was introduced here some four or five years ago, and has now become a very popular plant among the Chinese. It is usually cultivated for ornament in a jar of water with charcoal and stones, when it will flower if allowed sufficient light. The leaves have a swollen, fleshy petiole, and a round short blade. In too shady a place the petiole gets much longer and less swollen, and the whole leaf is much larger. In this state it does not flower so well. It grows by offsets from the base, and with surprising rapidity, and will fill up a pond very quickly if the place suits it. From this habit it has proved a great nuisance in Florida and Australia, choking up the rivers so that steamers could not pass. In Brazil it usually grows in damp water meadows which are almost dry at times, but when flooded the suckers of the plant drift off by the aid of their swollen petioles, and are carried far off by the water and deposited at other spots, where it grows again. It is grown here in some quantity also by the Chinese, in ponds, as they grow *Pistia stratiotes* and other plants, for feeding pigs. The flower spikes are hawked about in large quantities in Singapore for sale, and have become quite a feature in the streets. They are very beautiful, and certainly suggest a spike of large pink hyacinths, but they are, unfortunately, of short duration, lasting but a single day. Flowers are very seldom sold in Singapore, and, indeed, this is the first time I have ever seen them sold in this way.—(H. N. RIDLEY, Director of Botanic Gardens, Singapore, in the *Agricultural Bulletin* of the Straits, Vol. V, No. 4, p. 117.)

Hawkesbury Agricultural College and Experimental Farm.

NOTES FROM THE BOTANICAL LABORATORY.

C. T. MUSSON.

Grass Mildew.—A New Wheat Disease in Australia.

DURING September, examples of Federation wheat-heads were received from Tamworth (Mr. D. Woods, junior), stated to be affected by a white fungus, doing considerable damage. A further consignment, this time showing the whole plant, was received with the following statement attached:—

Appearance of the growing Crop.

"The crop was sown in the beginning of May, 25 acres. It is growing in light-red soil, on high land. It was first noticed that something was wrong early in the winter; one corner of the block looked white when seen from a distance; this white appearance is now all through the 25 acres (October 1). It is a hardy wheat, for through the dry spell which we had it was growing whilst other varieties close by were at a standstill. It was heavy and blue-looking. Close at hand are growing some Budd's Early wheat and malting barley, neither of which is affected by this fungus blight."

The Cause.

Examination quickly proved this disease to be mould or mildew of grasses and cereals, caused by a fungus known as *Erysiphe graminis*, DC., which, at times, seriously damages these plants, especially wheat, in other countries. It has been recorded on grasses in Australia, in its Oidium stage, but, so far, there appears to be no record of it having occurred on cereals. The late rainy weather would, doubtless, encourage it; though it is remarkable that up to now it has not been definitely known to attack our wheat.

Appearance of Plant—The Fungus.

The fungus causes the plant to appear whitish in patches on the leaves and stems; for its body, which consists of fine transparent white thread-like growths (*mycelium*), lies on the outside of the plant, sending down into the tissues tiny root-like organs, which take up food from the host to supply its own needs, thus robbing the host, and causing it to wither. The attacked parts dry up; the fungus meanwhile developing numerous minute outward-growing and short-fruiting stalks, on the ends of which appear chains of tiny oval, white, transparent spores (*conidia*) of the

ordinary oidial type as occurring on grasses, and usually called *Oidium moniloides*. Later, the trouble extends to the heads, the mildew appearing as a white felt on the glumes (chaff particles); the *conidia* being developed here also freely. After a time, small dark spots appear, immersed in the threads constituting the fungus body; these are also fruiting organs, being roundish flask-like receptacles, on the outside of which long simple thread-like outgrowths of *mycelium* are present; these are called appendages. Within these flask-like bodies, which are called *perithecia*, a number of longish, oval, transparent bodies are formed, each containing from four to eight special spores (*ascospores*). These latter act as resting spores; they do not mature for some months, and are the means by which the fungus retains its existence over a winter period, such as obtains in England. The ordinary *conidia* of the oidial stage of the fungus are much more plentifully formed: their special function being to germinate quickly, and at once start the fungus growth on some suitable plant, which must be a grass or cereal.

Remarks.

Seeing that this fungus has been known on grasses here for some time, and that only this year has it been noticed on wheat, it would appear that in our dry climate it may not be expected to attack cereals much. If, however, circumstances are favourable for it, the prevalence of damp conditions for instance, the trouble is likely to be heard of again. Not only would damp conditions favour the fungus, dry and sunny weather tending to check it; but in dry weather there is much dust blown about, and this has a decidedly detrimental effect upon the surface-living fungi, of which this is a prominent example—a fact which would also help to check it.

Result of Attack.

Where it occurs to any extent, the grain would not form, and the straw is likely to be almost useless for fodder. The special

Federation Wheat.
Ear attacked by powdery mildew (enlarged).

resting spores would remain in the ground awaiting their time for germinating; consequently ground where the crop has been attacked will be likely to give later crops of the same kind the same disease; the spores may retain their germinating power for some years.

As to the future.

Careful rotation will be necessary where it occurs, with prevention of any grass weeds from growing on the ground. There is no cure for such an attack as this, though powdered sulphur is the orthodox treatment for vine mildew, a related disease; but such an application is not practicable for growing wheat.

Summary.

It would seem that care in the method of cultivation, with rotation, and the rejection of varieties seen to be attacked, are the best practical means for keeping the disease down. Burning the diseased crop is decidedly the best method for getting rid of the innumerable fruiting bodies formed by the fungus, which, unless destroyed, are spread about by the wind, and will be the means of keeping the fungus alive on some suitable grass plant; this, however, would be a matter for the individual to decide.

NOTE.—Since communicating this note, examples have been received from Muswellbrook and Barraba on the same variety, in the former case on another variety also. The disease is probably more widely spread than at present appears.

HAWKESBURY AGRICULTURAL COLLEGE.

MONTHLY WEATHER REPORT.

SUMMARY for October, 1906.

Air Pressure (Barometer).			Shade Temperature.				Air Moisture Saturation=100.			Evaporation (from Water Surface).			
Lowest.	Highest.	Mean.	Lowest.	Highest.	Mean.	Mean for 14 years.	Lowest.	Highest.	Mean.	Most in a Day.	Total for Month.	Monthly Mean for 8 years.	% of year's Evaporation.
29·70 12th.	30·37 18th.	30·07	42·4 16th.	96 0 29th.	64·91	63·22	38 28th & 29th.	88 2nd.	58·61	·321 30th.	5·588	4·560	12·06

Rainfall...	Dates	1	2	3	4	5	9	22	31	Total,	Mean Rainfall for 14 years,
	Points ..	26	3	20	53	3½	12	2½	61	181.	180 points.

Wind ..	N	NE	SE	S	SW	W	NW
	11	6	2	7	2	2	3

Thunderstorms on 16th and 30th.

Greatest daily range of temperature, 51·4° on 29th.

Days on which temperature rose above 90° ..	22	23	27	28	29	30.
	90 0	90 6	93·2	94·3	96·0	94.

W. MERVYN CARNE,
Observer.

A Cheap Silo for the Dairy Farmer.

A. BROOKS,
Foreman of Works, Hawkesbury Agricultural College.

Never before in the history of this State has there been such an urgent request for a cheap form of silo as at present; and while dairy farmers recognise that if they are to succeed, and be able to tide over the dry seasons, they must have means of storing food, still only a few can afford to build a

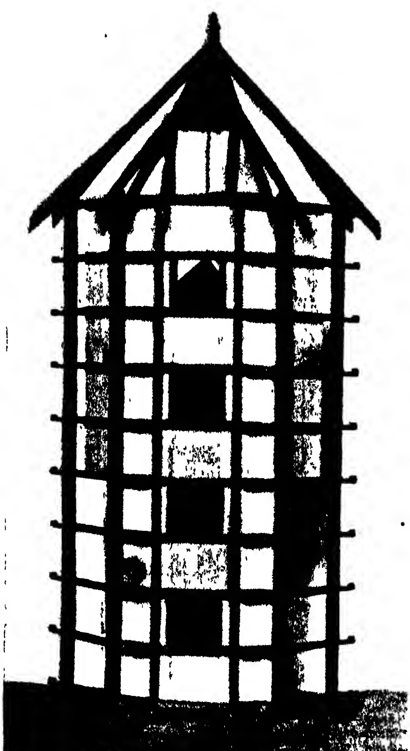


Fig. 1.

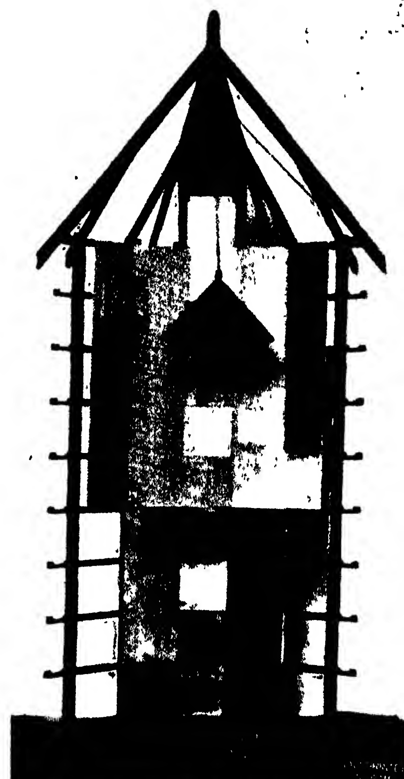


Fig. 2.

Figures 1 and 2 are from a photograph of a Model of a 70-ton Silo, requiring only two studs on each side.

silo if it is to cost the best part of £100. If a 100-ton tub can be erected for something like half that sum, a large number will, no doubt, invest in them.

Although cheap silos are undoubtedly necessary at the present time, yet, once our dairy farmers fully recognise their value, they will not hesitate to

build the larger and more permanent structures. Many so-called cheap silos are only so because the structure has only been half finished.

Undoubtedly silos can be built of materials other than wood, but not only are they more expensive, but cannot be built by any other than a skilled tradesman, which means greater cost. The stave pattern of round silo is undoubtedly a good one, but the timber for it cannot be supplied from amongst our native woods, and costs not less than 20s. per 100 feet landed on most farms. There being 3,250 feet super. in a 100-ton silo, the price of staves alone is £32 10s., and the other necessary materials cost quite an equal amount. Our native timbers can be purchased very much cheaper. What is wanted is a design for a silo in which they can be used. We cannot have the stave pattern because it would shrink too much, but we want it to be as nearly circular as possible.

The New Idea.

The silo herewith illustrated and described is one that can be built with Australian timbers; and further, if the owner cannot afford to finish it the first year, part of the work may be completed the second, after giving it a trial. In this way it is a cheap silo. As will be seen by the plans, it is octagonal outside and sixteen-sided inside, or practically round like the stave pattern.

To enable the handy man to build the silo, full directions and measurements are given, and the structure may or may not be completed, just as circumstances will allow.

The silo complete consists of the framework, lined on the inside with a double thickness of tongued and grooved boards, and on the outside with part iron and part Malthoid roofing-felt. The incomplete silo has one thickness of lining on the inside only, leaving the other and the outside covering for another time In this form it would be as shown in Fig. 1, Fig. 2 being an inside view.

Materials.

For the latter, to build a silo 25 feet high and 16 feet across, inside measure, the following are required:—

Foundation—
8 short pile stumps, 3 ft. long x about 10 in. dia. Hardwood.

Walls—
25 studs, 26 ft. long x 6 in. x 2½ in. Hardwood.
40 lengths for rails, 16 ft. long x 4 in. x 2½ in. Hardwood.
4 ,, ,, 16 ,, x 4 in. x 4 in. bottom frame, Hardwood.
250 ft. run of 2½ in. x 2 in. angle ties. Hardwood.
1,350 ft. super, 6 in. x ¾ in. T. and G. lining boards, Pine.

Roof—
1 piece 6 ft. long, 5 in. x 5 in., for finial, Pine.
250 ft. run. 3 in. x 2 in., for rafters. ,,
250 ft. run. 3 in. x 1 in., for battens. ,,
32 6 ft. sheets of 26-gauge corrugated iron.
2 lb. screws and 2 lb. lead washers.
8 lengths of 16 in. ridge capping.

Sundries—

7 doz. 6 in. x ½ in. bolts, nuts, and washers, for angle ties.
3½ doz. 3 in. x ½ in. ,, ,, for angles of rails.
8 only ¾ in. anchor bolts (see Fig. 3).
7 lb. 4 in. x 8 gauge nails.
7 lb. 3 in. x 9 ,,
14 lb. 2 in. x 11 ,,

NOTE.—The timber for the framework should be of the best quality, and as straight as possible, the lining should be with full and whole tongues and grooves, but need not be dressed on either side. The lighter kinds of hardwood would be preferable for the framework, and should be cut to a uniform size throughout, otherwise there will be more trouble in fitting together.

To complete the silo there will also be required 1,350 feet super. of 6 in. x ½ in. T. and G. lining boards, two rolls of 2-ply P. and B. paper, to lay on between the two thicknesses of lining for the inside, and for the outside twenty-four 8-foot sheets of corrugated iron, and two rolls of 2-ply Malthoid roofing-felt. The first lot will cost £25, and the latter £15, making it possible for the man who can build his own silo to have one to hold 100 tons, to cost from £30 to £45. Where suitable round timber can be obtained for the framework, even this may be reduced by £12. The cost of erection should not exceed £10 to £15.

Smaller silos cannot be constructed so cheaply at per ton capacity, being from 2s. to 2s. 6d. per ton more, while the larger ones are only about 6d. per ton less. Thus it is shown that the 100-ton tub silo is the best value for the outlay.

How to Build it.

Foundation.—For this, take the (8) stump piles (one for each angle of the octagon frame). Each should be bored and slotted out for the anchor bolt, as shown on Fig. 3., and the tops capped with a piece of old sheet galvanized iron before fitting the bottom plates on. They should also be charred before setting in the ground. The bottom frame of 4 in. x 4 in. should now be marked out, and this may be most easily done by measuring out on one edge of each of the 16 feet lengths 8 ft. 2 in., and with a bevel set to the angle of 45 degrees (square mitre) mark out the lengths thus:—

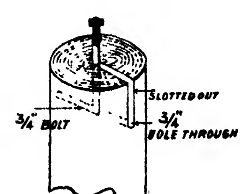
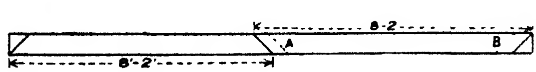


Fig. 3.—Foundation stump showing how anchor bolt is placed.



This cuts two lengths out of each 16 feet piece; on each of these mark another line at 5 inches from the points shown at A and B. With the eight pieces so cut and marked, lay out the octagon frame as shown on the ground plan in Fig. 4, the lengths laid alternately under and over each other at the corners, keeping the outer edges to the lines A and B, at 5 inches from the ends. Carefully mark the inside edge of each piece at crossings, and this gives the cuts to make to halve the frame together at the corners.

When cut out, the frame should be temporarily put together, laid down on the site, and the positions of each of the eight stumps marked out, the holes dug, and the stumps set in position, but not yet rammed. They must be carefully levelled on the tops.

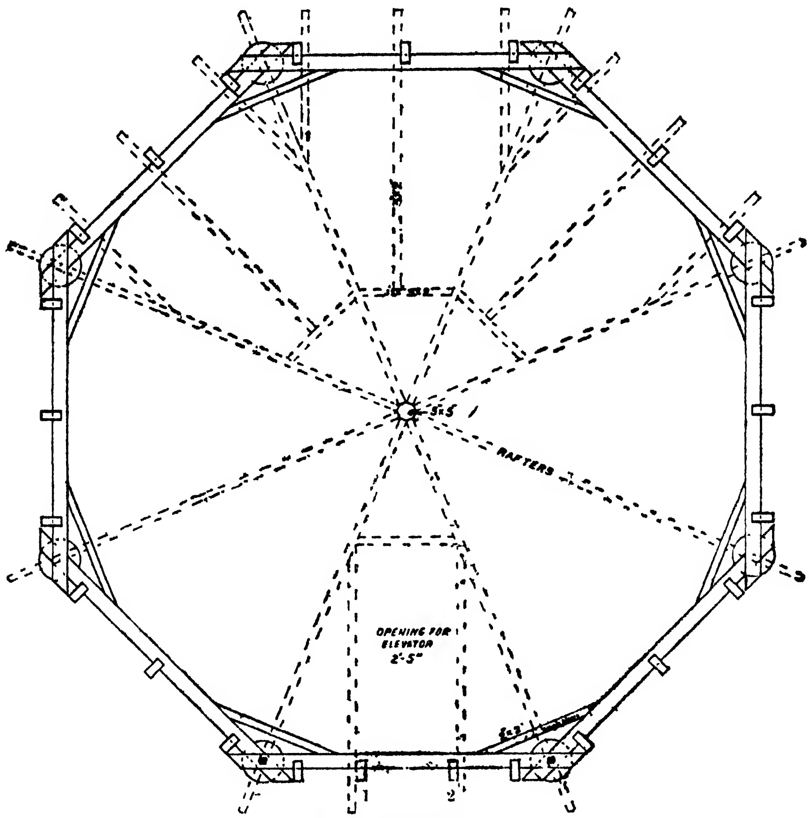
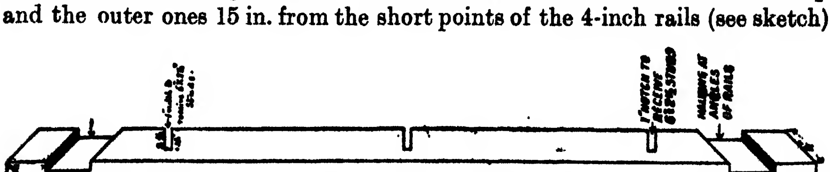
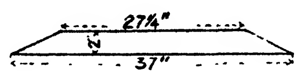


Fig. 4.—Ground Plan.

Through the centre of the halving joints at each angle of the octagon frame, bore the $\frac{3}{4}$-inch holes for the anchor bolts. Then place the frame on the stumps, bolt down, and the holes may be filled in and rammed. Now decide which side of the octagon it is required to have the doors in, because it will be noted there are four studs in this side and three in the others. See 1 and 2, on ground plan. Mark out the notches for the studs on each outer edge of each of the eight sides. These notches will be 1 in. wide x 2 in. deep, and the outer ones 15 in. from the short points of the 4-inch rails (see sketch).

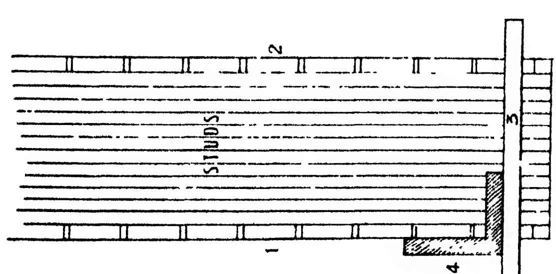


On the side the doors are to be placed, there will be the extra, or fourth, stud, the space for the doors being 24 inches clear. This provides a pattern for all the remaining ten frames of 4 in. x 2½ in. stuff, which may be made one at a time and laid aside. The angle scarfings should not be too tightly fitted, otherwise they will be troublesome to get together when setting up, and every second frame should be bored at the angle scarfs for 3 in. x ½ in. bolts. The 2 in. x 2½ in. angle tie pieces, as shown on the foundation plan (Fig. 4) should also be fitted, and those for every second rail, as before, bored through to take the 6 in. x ½ in. bolts; the heads of these to be inside the frame and sunk flush. Each piece will measure 37 inches on the long points and 27¼ inches on the short points, thus:—



The whole of the frames (11) will then be completed as shown at Fig. 4.

Now proceed to prepare the studs which are 26 feet long, 6 in. x 2½ in. Take two and lay side by side, with the inner edges upwards. Mark a line square across both at 4 inches from one end (the bottom end), then another to suit the thickness of the bottom rails (4 inches). Then set out the lines for the other ten rails, 2½ inches thick, at 27 inches distance in between. This will make the total height 24 ft. 11 in. over the rails. Note the thickness of the material, and, should it vary, take the smallest, and fit each individual rail afterwards; a lot of extra trouble will be avoided if well-cut timber is available. Square these lines so set out across the two studs, and this affords a pattern pair for the remainder, which should now be laid out as



the first two, the inner or round edges upwards, and square at one end. Place one of the pattern studs on each side of the lot (see sketch 1 and 2), and, using a square and short straight-edge, as 3 and 4, set the lines of 1 and 2 at right-angles with each other. Now, using the straight-edge, draw the lines

across the lot, and then taking each one separately mark the notches out on the sides, as shown in Fig. 5, and cut out ¾-inch deep.

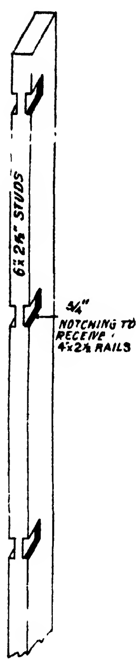


Fig. 5.

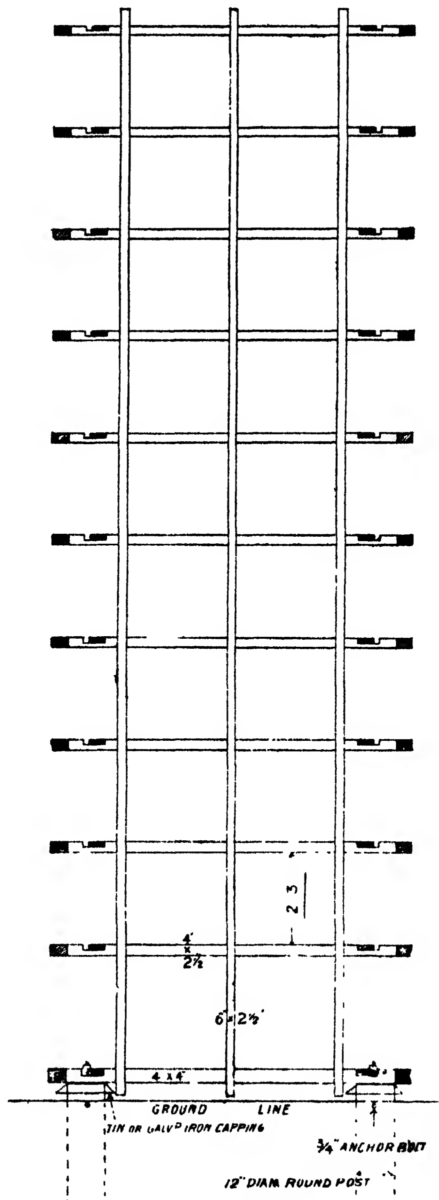


Fig. 6.—One section of wall framing.

When all the studs have been notched out for the rails, the eight side frames may be fitted and nailed together, when they will be just like eight ladders,—

see Fig. 6. Let the bottom frame set on the foundation blocks. On this frame, as set on the blocks, set out and fit together all the parts of the roof,

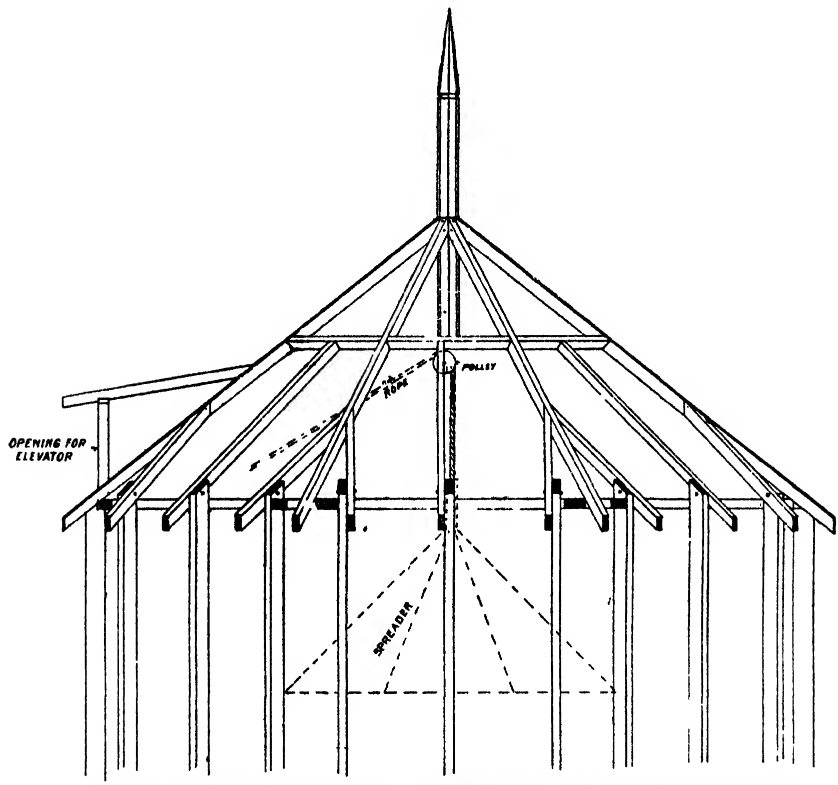
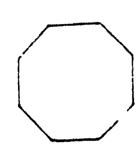


Fig. 7.—Showing construction of roof. The hanging spreader is indicated by dotted lines.

including the iron (Fig. 7). This will no doubt be found to be the most difficult part of the work for the average handy man. However, take the 5 in. x 5 in. finial piece and plane it off on the corners until it has eight equal sides, as the frame itself, thus:—

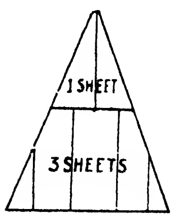


Cut off four long rafters out of the 3 in. x 2 in. stuff, each as shown, thus:—

the total length of each rafter being 11 ft. 9 in. These four rafters and the finial may be set up next. Any fitting required may now be done; then, using one as a pattern, cut the other four, and set up the eight in each angle of the octagon frame. The correct lengths and levels for the short jack rafters can be obtained with a rod and

the shifting bevel, the overhanging foot being the same in every case. The opening for the head of the elevator can be best understood by a reference to the drawing—Fig. 7. The battens should be cut and temporarily nailed in their positions, and the iron cut to fit.

To cut the iron to work in without waste, it should be as shown in the following diagram, which works out at four 6-feet sheets for each side, or thirty-two sheets for the whole roof. At the opening for the elevator, the sides are closed in with ¾-inch lining boards, and one sheet of iron will be sufficient for the roof.



The roof timbers may now be taken apart and laid aside until the wall frames are up. Starting at, say, the side with the door opening (see ground plan, Fig. 4), and calling it No. 1, raise it up either by two battens fastened on the studs about 6 feet from the top ends, or with a derrick pole, pulley, and ropes, and, when in position, stay with battens from the ground. In a similar way raise up Nos. 3, 5, and 7, then Nos. 2, 4, 6, and 8, when the whole can be securely fastened at the angles with the bolts and nails. With a few planks laid across the second top rails, you have a scaffolding on which to stand and fix your roof, already prepared. Finish it completely before doing any other part of the work. Cut off the ends of the studs flush with the battens. When fitting on the iron, if sufficient care be taken to fit it close together, the ridge capping might be dispensed with, and a batten nailed on instead and painted. This would save a little. To include the spreader shown at Figs. 8 and 9 it should be made and left in position under the roof, as it would be difficult to fix afterwards. The drawings will explain its construction, which is much like the octagon roof, the rafters being battens, and the covering 6 in. x ½ in. lining, and hung with ¾-inch rope over a 4-inch pulley, from the lower end of the roof finial.

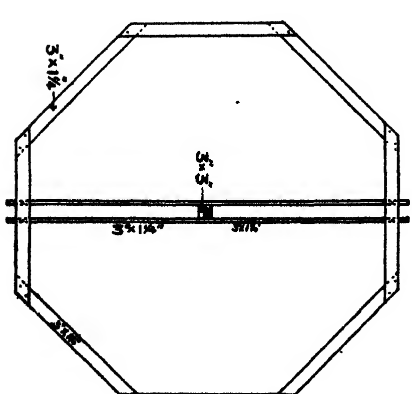


Fig. 8.—Plan of Spreader.

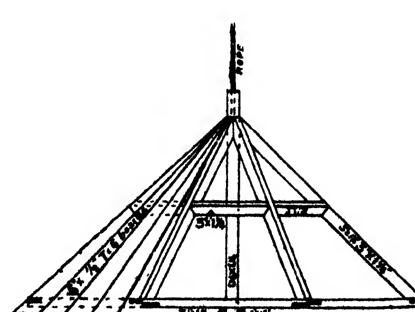


Fig. 9.—Elevation, part boarded.

Unless the silo is to be completed outside and inside, there is now only the 6 in. x ¾ in. inside lining to fix, and the doors to fit. The planks used for the roof scaffolding will now be available. Before starting the lining, the bottom frame, including the lower ends of the studs, should have a coat of hot tar. To retain the dry earth floor, pieces of old sheet iron should be nailed on the inside edge of the bottom plate, hanging down about 2 or 3 inches into the solid ground. The floor may be of any hard earth, rammed fairly level on top. To fix on the lining boards, little need be said. They should have full tongues and grooves, and be closely nailed together. Should the angles not prove sufficiently close at the joints they may be improved, by either bevelling the two edges of a lining board and fix it close, or tack a strip of felt on. This, of course, would not be required if the silo is to be completed. At a cost of 30s. the whole of the inside face can be lined with 2-ply P. and B. paper, which would make a sure job, the paper being fixed horizontally with tacks.

Figs. 10, 11, 12, and 13 show how the doors are made and fitted. They may be either of a double thickness of lining, or of 1¼ inch stuff in one thickness, cross ledged, and the ends of the ledges housed into the framing. This would finish the silo for the man who could not afford the cost of completing it. The quantity of necessary material to complete with has already been given on page 1227.

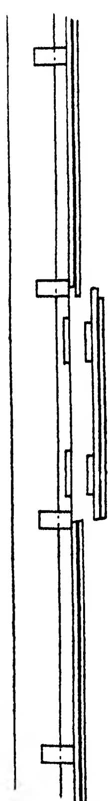


Fig. 10.—Section showing how doors are fitted.

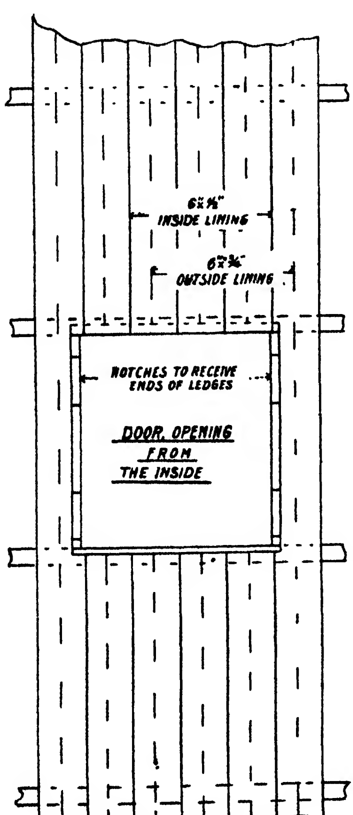


Fig. 11.

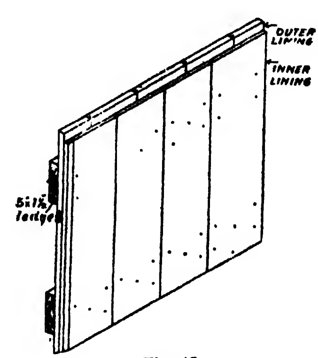


Fig. 12.

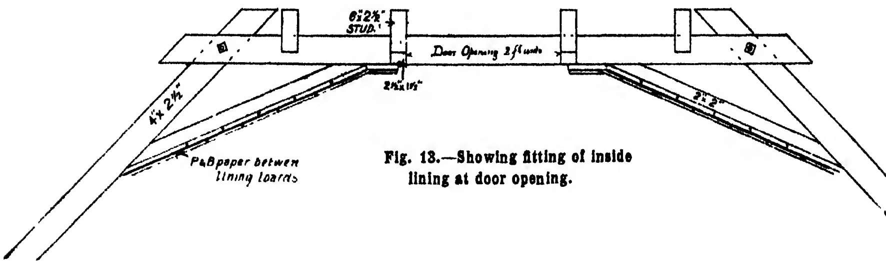


Fig. 13.—Showing fitting of inside lining at door opening.

Elevator.

For the elevator, a three-sided shoot, made of pine boarding and battens, about 35 ft. long x 12 in. wide x 4 in. deep, inside measure, is required. The bottom should be fixed with the grain of the wood lengthways. Fittings, consisting of sprocket wheels, link-chain belt, and carrier attachments, which may be had from the "Link Belt Company," 22 Clarence-street, Sydney, are also required, the cost being between £9 and £10.

For the benefit of those desiring to order these fittings, the following is what are required:—

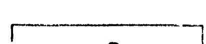
Top Gear.

One 8 in. diam. No. 67 sprocket wheel, 1¼ in bore, S.S.
Two 1¼ in. take-ups.
Two 1¼ in. wrought-iron collars.
One 1¼ in. shaft, 24 in. long.

Bottom.

One 8 in. diam. No. 67 sprocket 1½ in. bore, K.S.
Two 1½ in. heavy brass bearings.
Two 1½ in. iron collars.
One 1½ in. shaft 30 in. long.
One 18 in. diam. No. 67 sprocket, 1½ in. bore, K.S.
One 6 in. ,, No. 67 sprocket bore to G.K.S.
72 feet No. 67 chain F2, attachments at 18 in.
2 pair of No. 67 couplers.
10 feet No. 67 chain.
1 gross of 1½ in. x ¼ in. cup-head bolts.
2 grease cups and tubes.

The battens for the carriers to bolt on to the (F2) attachment links in the chain, should not be heavier than 2½ in. x ⅞ in. pine, and requires to have a notch taken out of the lower edge to admit the teeth of the sprocket wheels.



It will be noted that this silo, when lined on the outside, leaves the outer edges of the studs exposed to view. If these are coloured, and the remainder of the outside of the walls coated with one of the many mixtures of lime washes, the silo will always look well.

Farmers' Fowls.

[Continued from page 1147.]

G. BRADSHAW.

Chapter XLII.

Conclusion.

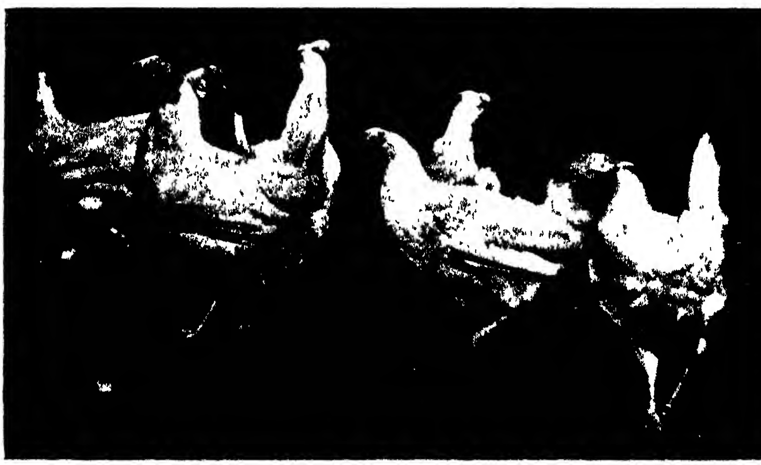
Having now shown the many advantages which farmers possess enabling them to do well with fowls, there are other considerations which should still further assist in making this issue of the farm a very profitable one. In profitable poultry breeding, eggs are the chief stand-by. Any well-cared for flock of fowls of a good laying strain, young and healthy, will produce eggs all the year round: but no matter how well managed, nor when the birds be hatched, the larger number of eggs will be laid in the spring months, when they are cheapest. The laying competitions in this and other States have shown that individual hens have laid as many

Farmers' Fowls. The above six Black Orpingtons laid 1,461 eggs in twelve months.

as 20 dozen eggs each, still a flock of the very best selected will fall far short of that number, there being undetected drones in every poultry-yard; consequently, it will not be fair to draw deductions from any individual fowl, nor from a single annual competition, but to take a series of such.

The Hawkesbury College have completed four annual tests, the average laying per hen for the respective years being 130, 160, 154, and 156, the average of these four tests thus showing 153 eggs, or 12¾ dozen for each hen, and the farmer or other poultry-keeper who secures 12 or even 11 dozen from each member of his flock during the twelve months will have a profitable return from his fowls.

The time when these eggs are produced is another important matter, seeing that the price for one or two months is as low as 7d. per dozen, and at other periods as high as 1s. 8d.; but, taking the year right through, the average of late has been about 1s. per dozen, and considerably higher than in any other State, the Queensland and South Australian markets only averaging 8d. or 9d. per dozen. Other markets are still lower, particularly the United States, where they can profitably produce eggs at 5 to 7 cents per dozen less than here. However, the farmer or other poultry-keeper in New South Wales has no need to accept 7d.



Farmers' Fowls. The above six White Leghorns laid 1,448 eggs in twelve months.

per dozen for his eggs, for, unlike other countries, there is a Government here ever anxious to help the producers, which, in the matter of eggs, is in the provision made for cold storage. This system was incepted by the Agricultural Department in 1897. Its popularity and advantages can be best realised by the fact that during the past year 288,648 dozen were placed in cold storage, and at the end of five or six months profitably marketed, from 1s. to as high as 1s. 6d. per dozen being obtained.

As showing the extent to which farmers and others avail themselves of this system of increasing their profits from poultry breeding, the following figures, taken from the Superintendent's report, will be of interest:—

1898 ...	11,000 doz.	1901 ...	140,292 doz.	1904–5...	251,640 doz.
1899 ...	93,000 ,,	1902–3...	130,524 ,,	1905–6...	288,648 ,,
1900 ...	96,000 ,,	1903–4...	151,128 ,,		

The storage of eggs fluctuates very much in ratio with the prices. In January and February, 18 and 45 cases were received, while in March, April, May, June, July, and August, none were put into store, the season being practically closed; but, opening again on 1st September, 5,097 cases were received, followed by 2,654 cases in October, 166 in November,

and 38 in December, or a total of 8,018 cases. The deliveries, however, were—in January, 261; February, 448; March, 1,208; April, 2,025; May, 2,285; June, 538; July, 15; August, 12; September, 10; October, 5; November, 68; December, 403; or a total of 7,278 cases. The receipts and deliveries, as shown above, afford a correct monthly index to the market value of the product of the hen, one season being almost a duplicate of its predecessor.

The spring months of September and October are those wherein all poultry produce the greatest quantity of eggs, and, the markets then being at their lowest, farmers and others largely confine themselves to these months for storing; and, although with but the one object of holding over till a dearer period, this has the additional effect of relieving the overstocked markets in the months mentioned. Indeed, had cold storage not been available during the past season, and the above 288,000 dozen left on the local market, the result would have been disastrous to the producers. Again, just as certain spring months in the year are the cheapest, and those wherein the greatest storage is done, in the same way two or three of the early winter months, particulary April and May, are the dearest for this product, and those wherein the largest deliveries take place. At the same time, once February arrives, a distinct rise takes place, and from this on deliveries are made in increasing numbers till the months mentioned, June generally witnessing a clearance. This gradual and lengthened delivery, as opposed to the brief season of receiving, has the wholesome effect of the market never being overstocked with the Cold Store eggs to an extent of affecting the price of the current arrivals during the dear period of the year.

Farmers' Fowls. The above six Silver Wyandottes laid 1,808 eggs in twelve months.

The procedure in relation to the cold-storage system is simplicity itself. The producer in any part of the State has only to take his case or cases

of eggs to the nearest railway station, and address them to the Government Cold Stores, Sydney, and pay freight; the Government collect the eggs and place them in cold storage, and when the dear winter months arrive deliver them to the depositor's order, to be disposed of where and how he desires, the charges of 1d. per dozen for twelve weeks to be paid on delivery.

Many country people wonder why there should be so many prices of eggs in the Sydney markets, and experience some difficulty with the

Farmers' Fowls. Black Orpingtons. General utility; weight, 6 hens, 38½ lb. The six hens laid 1,188 eggs.

various egg quotations of the daily papers. The following extract, from an article I contributed to the "Guide for Immigrants," will be explanatory on this subject:—"What are known as 'New Laids' are from the suburban poultry-farmers, orchardists, and others who bring in a few dozen each sale-day. These are rarely more than one week old. They embrace small lots of from 3 to 10 or 20 dozen, and are usually purchased by boarding-house keepers, and grocers who have a special trade for the best goods. They bring 1d. to 1½d. per dozen more than any others offered. 'Railways,' as the name indicates, come by rail, mostly from farmers along the railway route. These are usually of good quality, and come next to new laids in price. Following these are 'Souths,' or South Coast. These come from the various ports of call south of Sydney, beginning at Wollongong and extending to Eden. 'Norths' or 'Northern Rivers' come not only from the North Coast, but in some instances 100 miles or more away up the extreme reaches of northern rivers—The Tweed, Clarence, Richmond, and others. In the winter season, not more than 2d. per dozen separates these from the suburban article, but in the hot weather they range as much as 4d. below. The 'Cold-room' eggs are those which have been in the chilling-rooms, say from September to the

dear time in May and June, and usually bring from 1s. to 1s. 4d. or more per dozen. The following is the average monthly prices for the three principal lines during the past year:—

	Norths.	Souths.	New-laids.		Norths.	Souths.	New-laids.
	s. d.	s. d.	s. d.		s. d.	s. d.	s. d.
January ...	0 11¼	1 0¾	1 3	July ...	0 11	0 11¾	1 2
February	1 0	1 1½	1 4¼	August ...	0 8	0 8¾	0 9
March ...	1 2½	1 3½	1 6	September	0 7¼	0 7	0 8¼
April ...	1 4½	1 6½	1 10	October...	0 7	0 6¼	0 7¼
May ...	1 5¼	1 7	1 9½	November	0 5¾	0 7¾	0 9
June ...	1 2½	1 3½	1 6¼	December	0 7¾	0 8¾	0 10½

The average price for the past four years was:—In 1901, 1s.; 1902, 1s. 4d.; 1903, 1s.; 1904, 1s.; 1905, 11¾d.

The next advantage which the poultry-farmer here has over his compeers in other countries is the excellent all-the-year-round market for his poultry—indeed, for eight or nine months of the year the Sydney prices are considerably higher than what obtains for the same class of goods in England. Appended are the figures supplied me a few months ago by the four city poultry salesman, all showing the profitable nature of producing good table fowls for the Sydney markets:—

Haymarket, 5 July, 1906.

Sir,—Replying to your favour of the 27th ultimo, I have pleasure in forwarding herewith list of the top prices obtained by me between May, 1905, and May, 1906. Although these are the top prices realised in the months stated, I think it is only fair to point out that these figures were much more frequent during the months of August to March inclusive; while for the months of June, July, April, and May, they were exceptional prices, and not so frequent as in the other months. Further than this, I feel that it should not be lost sight of, these birds were sent in in the ordinary course of business, many of them coming to me by steamer, thus not having the benefit of the special conditions that birds prepared for a prize test for export would undergo. I frequently recommended my consignors to push on the growth of their cockerels, and market them at four to five months' old, at most, instead of holding them for two or three months longer for the slight advance in the price. I am fully impressed that our market demand is not so much for a large bird as for a medium-size plump bird of a tender age. You are at liberty to make use of my name in your report should you think fit.

Yours, &c.,
C. J. TURNER,
The Poultry Farmers' Exchange.

List of Prices, as advised per letter of even date.

1905.	s. d.	s. d.	s. d.	s. d.	1906.	s. d.	s. d.	s. d.	s. d.
June ...	5 6	5 3	5 0	4 11	Jan.	6 9	6 6	6 0	5 8
July ...	6 3	5 6	5 4	5 3	Feb.	6 9	6 6	6 5	6 4
Aug. ..	6 6	6 1	6 0	5 9	March .	6 9	6 6	6 3	6 0
Sept. ...	8 0	6 7	6 6	6 0	April ..	6 11	6 10	6 7	6 4
Oct. ...	6 9	6 7	6 4	6 2	May ...	7 3	6 9	6 3	5 9
Nov. ...	7 0	6 11	6 9	6 7					
Dec. .	7 9	7 4	7 0	6 11					

Sydney, 4 July, 1906.

Sir,—In reply to yours of the 27th instant, attached you will find information required. We might also inform you that we so rarely get sales of English ducks (Aylesbury, Pekin, &c.) that we could not report to you anything reliable. You have our permission to insert the firm's name in your article.

Yours, &c.,
ELLIS & CO.,
Poultry, &c., Salesmen.

HIGHEST Prices realised at our Sales.

1905.			s. d.	1906.			s. d.
May	...	Fowls (Roosters)	5 6	Jan.	...	Fowls (Roosters)	7 6
June	...	,,	5 10	Feb.	...	,,	6 11
July	...	,,	6 6	March	...	,,	6 5
Aug.	...	,,	6 8	April	...	,,	6 3
Sept.	...	,,	5 8	May	...	,,	7 4
Oct.	...	,,	7 6				
Nov.	...	,,	6 6				
Dec.	..	,,	7 6				

Sydney, 2 July, 1906.

Sir,—In accordance with your request, I have pleasure in forwarding a list of highest prices obtained for cockerels and English ducks at our weekly sales. We held no sales prior to October, and, consequently, cannot get behind that date. It should also be remembered that for the space of at least three months our prices were adversely affected by the buyers carrying on a boycott. I have put down the figures for each consecutive week.

Yours, &c.,

THOS. REID,

The Poultry Farmers' Co-operative Society (Limited).

EXTRACTED from Weekly Sale-sheets.

Date.	Cockerels.					English Ducks.			
1905.	s d.	s. d.	s. d.	s. d.		s. d.	s. d.	s d.	s. d.
October ...	4 10	5 0	5 7	5 9	...	2 9	2 10	3 0	3 3
November ...	5 11	6 9	6 4	6 0	...	3 0	3 11	3 10	3 4
December ...	6 3	6 5	6 10	7 6	...	3 6	3 11	3 10	5 4
1906.									
January ...	6 2	4 9	6 0	5 9	...	3 11	4 5	3 9	3 7
February ...	6 9	5 7	6 5	..	...	3 1	2 8	3 4	...
March ...	5 3	6 1	6 0	5 10	...	3 1	2 10	2 10	3 0
April ...	5 3	5 6	5 5	5 8	...	3 7	3 7	4 0	3 10
May... ..	6 0	5 9	6 1	5 6	...	4 4	3 9	5 6	4 3

Sydney, 9 July, 1906.

Sir,—In reply to yours, I have gone through my account sales journals with the following result, *re* best prices for fowls at auction from May, 1905, to May, 1906:—

1905.	s. d.	s. d.	s. d.	s. d.	1906.	s. d.	s. d.	s. d.
May... ...	3 10	4 4	4 1	4 6	Jan. ...	5 9	6 9	7 6
June ...	4 10	5 0	5 1	5 2	Feb. ..	4 9	5 3	5 9
July... ...	5 0	5 2	5 3	5 8	March...	5 0	5 6	6 3
August ...	5 4	5 6	5 9	6 0	April ...	5 6	6 3	6 7
September ..	5 10	5 11	6 2	...	May ...	5 9	6 3	6 6
October ...	5 11	6 0	6 9	...				
November ..	5 10	6 4	6 7	...				
December ...	5 9	6 6	7 9	...				

Yours, &c.,

W. F. MURPHY,

R. T. Murphy and Company.

Should prices such as above materially drop, there is always a market awaiting in England; and in this branch the Government again acknowledges its maternity to those on the soil, by preparing their birds for the

oversea markets. These, like eggs, are to be forwarded, freight paid, to Sydney, where they are received by the officials there, killed, plucked, dressed, frozen, and placed on board at the inclusive nominal charge of 3½d. per head for fowls and ducks. In the very plentiful and cheap times as many as 120,000 head of poultry have been exported; the high prices of later years, as shown above, having considerably contracted the export trade, which last year totalled but 7,955 fowls, 3,310 ducks, 850 geese, and 3,438 turkeys. However, should there be a continuance of good seasons, and the corollary of cheap foods, poultry may again increase beyond our own consumption, and the oversea market will again have to be resorted to; and as a guide to the prices to expect, the following is supplied by a leading poulterer of Leadenhall Market for the best quality of dead fatted fowls. The prices quoted are for each bird, and should our quality approach those quoted, there will be a deduction for freight, freezing, and other charges of from 9d. to 10d. per bird:—

Fowls.	January.	February.	March.	April.	May.	June.
Yorkshire ..	2/- to 3/6 each	2/- to 3/- each	2/3 to 3/6 each	2/3 to 2/6 each	2/3 to 2/6 each	2/6 to 3/3 each
Essex . .	2/- to 3/3 ,,	1/9 to 3/- ,,	2/3 to 3/6 ,,	2/3 to 2/6 ,,	2/3 to 2/6 ,,	2/3 to 3/6 ,,
Surrey .. .	2/- to 4/6 ,,	2/3 to 5/- ,,	2/6 to 5/- ,,	2/6 to 5/- ,,	2/6 to 5/- ,,	4/- to 6/- ,,
Sussex ..	2/- to 4/6 ,,	2/- to 5/- ,,	2/6 to 5/- ,,	2/6 to 5/- ,,	2/6 to 5/- ,,	3/- to 6/- ,,
Welsh .	1/6 to 2/6 ,,	1/6 to 2/6 ,,	2/3 to 3/- ,,	2/3 to 3/- ,,	2/6 to 3/- ,,	2/6 to 3/3 ,,
Irish . ..	1/6 to 2/3 ,,	1/6 to 2/- ,,	2/3 to 2/9 ,,	2/3 to 3/- ,,	2/6 to 3/6 ,,	2/6 to 3/3 ,,
Hens (Old)	1/6 to 2/6 ,,	1/9 to 2/9 ,,	1/9 to 2/9 ,,	1/9 to 3/3 ,,	1/9 to 2/6 ,,	1/9 to 2/6 ,,
Capons	4/- to 5/6 ,,	4/- to 5/6 ,,	4/6 to 7/- ,,	4/6 to 7/- ,,	5/- to 7/- ,,	5/- to 7/6 ,,
Ducklings	2/6 to 4/- ,,	2/6 to 4/6 ,,	4/- to 7/- ,,	3/3 to 8/6 ,,	4/- to 8/6 ,,	4/- to 6/- ,,
Goslings . .	4/6 to 7/6 ,,	4/6 to 7/- ,,	5/- to 8/- ,,	5/6 to 8/6 ,,	5/- to 8/- ,,	5/- to 8/- ,,
Turkeys	8d. to 1/2 per lb.	8d. to 1/- per lb.	8d. to 1/- per lb.	8d. to 1/- per lb.	8d to 1s. per lb.	8d. to 1/- per lb.
Eggs. English best new laid.	18/- to 20/- per 120	12/6 to 14/- per 120	8/- to 10/- per 120	7/- to 8/6 per 120	7/- to 8/- per 120	8/6 to 9/- per 120

Fowls.	July.	August.	September.	October	November.	December
Yorkshire . .	2/- to 3/- each	2/3 to 3/6 each	1/6 to 2/6 each	1/9 to 3/- each	2/- to 3/- each	1/9 to 3/- each
Essex	2/3 to 3/- ,,	2/- to 3/- ,,	1/9 to 2/6 ,,	1/6 to 2/9 ,,	2/- to 2/9 ,,	1/9 to 2/9 ,,
Surrey . .	2/6 to 5/- ,,	2/6 to 4/6 ,,	2/- to 3/- ,,	2/- to 4/- ,,	2/3 to 4/- ,,	2/3 to 4/- ,,
Sussex . .	2/6 to 5/- ,,	2/6 to 4/6 ,,	2/- to 3/- ,,	2/- to 4/- ,,	2/3 to 3/9 ,,	2/3 to 4/- ,,
Welsh	2/- to 3/- ,,	2/- to 3/- ,,	1/6 to 2/6 ,,	1/6 to 2/6 ,,	1/6 to 2/- ,,	1/6 to 2/6 ,,
Irish .	1/6 to 2/6 ,,	1/9 to 2/6 ,,	1/3 to 2/- ,,	1/3 to 2/- ,,	1/3 to 2/- ,,	1/3 to 2/- ,,
Hens (Old) .. .	2/- to 2/6 ,,	1/9 to 2/9 ,,	1/6 to 2/- ,,	1/6 to 2/6 ,,	1/6 to 2/6 ,,	1/6 to 2/6 ,,
Capons .. .	5/- to 7/6 ,,	5/- to 7/6 ,,	4/- to 5/- ,,	4/- to 5/- ,,	5/- to 6/6 ,,	4/6 to 6/- ,,
Ducklings ..	....	3/- to 4/- ,,	1/6 to 2/6 ,,	2/- to 3/- ,,	2/3 to 3/3 ,,	2/3 to 3/6 ,,
Goslings ..	....	5/- to 7/- ,,	4/- to 5/6 ,,	4/6 to 7/6 ,,	4/6 to 6/- ,,	4/6 to 8/6 ,,
Turkey Poults ..	5/- to 8/6 ,,	8d. to 1/- per lb.	4/6 to 7/- ,,	4/6 to 8/- ,,	5/- to 12/- ,,	. . .
Turkeys . ..	....	....	....	.....	....	4/6 to 25/- ,,
Eggs. English best new laid.	9/- to 10/- per 120	10/- to 11/- per 120	10/- to 12/- per 120	10/- to 13/- per 120	16/- to 18/- per 120	17/- to 19/- per 120

Within the present year there has been a good deal of agitation in South Australia regarding the export of eggs to England, resulting in the Government financially assisting a trial shipment of 700 cases.

However, seeing that the egg imports into this State are annually increasing, amounting last year to the almost incredible number of 1,452,207 dozen, it is scarcely likely that for a very long time we will have any to spare for export. Should a time of over-supply arrive,

the English market awaits us, and it should be known that these goods are disposed of there by what is known as the long hundred, of which the following table is explanatory :—

Per 120 or long hundred.				
15/-	=	8 a shilling,	or 1/6	per dozen.
13/4	=	9 ,,	1/4	,,
12/-	=	10 ,,	1/2½	,,
10/-	=	12 ,,	1/-	,,
9/3	=	13 ,,	-/11	,,
8/7	=	14 ,,	-/10¼	,,
8/-	=	15 ,,	-/9½	,,
7/6	=	16 ,,	-/9	,,
6/8	=	18 ,,	-/8	,,
6/-	=	20 ,,	-/7¼	,,

From all the foregoing, it will be seen that we have an excellent paying all-the-year-round market for both poultry and eggs; but should a time in the distant future arrive when our local demand is more than met, then there is the English market to fall back upon. However, it will be an evil day for the poultry-man when he has to compete in England against the Russian peasants, who can payably produce four eggs for 1d., and make money by rearing 3 lb. weight chickens at 6d. each.

Our great distance and expense in reaching the English market is another handicap to the establishing of a permanent profitable oversea trade in these products, which, with other factors, prompts the hope that, in the interests of poultry-breeders, our local markets may continue in the future the highly payable ones they have done in the past.

[The End.]

Asparagus Culture at the State Labour Farm, Randwick.

THE State Labour Farm is situated at Bunnerong-road, between Randwick and Little Bay, and quite close to the tramline to La Perouse.

The country is covered with scrub, and swampy in the vicinity, little land being cultivated, the fact that it is very suitable for vegetable

Asparagus grown at the State Labour Farm, Randwick; variety, Connover's Colossal.

growing, owing to its sandy nature and proximity to the Sydney market is hardly known. The vegetable that has been most successful on the Farm has been asparagus, and, as will be seen from the illustration, it makes vigorous growth under the system of cultivation adopted by Mr. W. J. Pearce, Depôt Manager.

Mr. Pearce considers asparagus one of the most profitable and, at the same time, the simplest vegetable to grow, especially in the sandy, swampy ground of that district.

The variety grown at the Farm is Connover's Colossal, an excellent and popular variety, which commands the highest price on the Sydney market.

The bed from which the bunches were cut, which are illustrated, is a new one, having only been planted fifteen months, so it will be seen by the size how quickly it has come on. On this bed, 3-year old crowns were planted; these, however, are not always available, 2-year old crowns being the oldest obtainable. Of course, asparagus may be raised from seed, but in this case more time must elapse before a profitable crop is obtained.

There are older beds than this at the Farm, from which large yields are being obtained.

Mr. Pearce estimates the cost of preparing and planting asparagus, as follows:—

	£	s.	d.
Trenching land 2 feet deep, per acre	17	0	0
Seaweed, 30 loads at 3s.	4	10	0
Stable-manure, 30 loads at 3s.	4	10	0
4,000 asparagus crowns, at £2 per 1,000 ...	8	0	0
Laying out beds and planting	4	0	0
	£37	0	0

The next year's outlay may be reckoned at about £20 for labour and manure.

If 3-year old crowns are planted, a fair cutting may be expected about fifteen months after planting, which may be estimated to return from £30 to £40. The following year the returns, under careful management, should be nothing short of £80 per acre. This would leave a very fair margin for cost of upkeep, labour, and picking, which latter must be done frequently, and the asparagus neatly bunched and the ends made even, so that it presents a fresh and good appearance on the market.

The asparagus supply at present is very poor, and if it were not for the large importations of canned asparagus from California and elsewhere the market would be ill supplied. In California, the area cultivated with asparagus to keep the many canneries going is about 7,000 acres, and is a very important industry in that State.

The field here is clear, with a growing market at hand, and when the time comes there are numerous canning factories that will only be too ready to undertake asparagus canning if they can be sure of a steady supply.

Weather Conditions during October, 1906.

H. A. HUNT,
Acting Meteorologist.

ON the 1st, monsoonal influence developed thundery conditions over the western parts of our State, giving rise on the 3rd to a disturbance of cyclonic formation, situated over southern parts, which caused unsettled or showery weather over New South Wales until the 6th: the centre of this disturbance moved in a south-east course through Victoria and the Straits. A short interval of fine weather supervened from the 6th to the 8th. On the latter date a monsoonal trough extended down through the western parts of Queensland and our State, causing heavy rains, squalls, thunder, and hailstorms, over our central and eastern districts. This was followed by an unusual acceleration in the rate of motion eastwards; during the twenty-four hours ending 9 a.m. on the 10th, the body of the atmosphere in our latitude had moved a distance of, approximately, 1,500 miles, the normal rate being 500 miles. On the 12th, some incidental falls of snow, the result of antarctic disturbance, were registered over the Monaro country. On the following day this disturbance caused very low barometers, steep gradients, and, consequently, violent winds over Victoria and Tasmania, the lowest readings being down to 29·0 inches at the centre, which was situated to the south-east of Tasmania. This disturbance was followed by finer conditions under the control of a high-pressure system; but monsoonal influence again reasserted itself on the 17th, causing a succession of scattered rainfall, largely the result of thunderstorms, which continued, with some interruptions, till the 26th. Finer conditions then supervened till the end of the month.

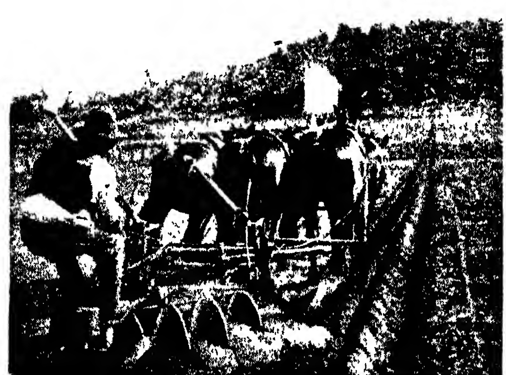
Taking the month as a whole, the rainfall has been useful, and at a majority of the stations, especially over northern and central parts, the fall has been above the average—Hungerford, on the Paroo, shows an excess of 232 per cent., and Bourke an excess of 135 per cent., above the average. Over the greater part of Riverina, south-western slopes, and southern highlands, the falls were uniformly above the average, ranging from 25 to 195 per cent. above. A slight defect occurred over extreme western, coastal, and highlands; the falls in these districts, although good, were generally below the average.

COMPARISON WITH INDIA.

The following statement shows a brief comparison of meteorological conditions over India, togther with those in our State, for the month of October :—

	Departures from Normal.		General Conditions. (Referring to the State as a whole.)
	Pressure.	Temperature.	
India...	+ ·01	+ 0·5	Larger defect.
Sydney (New South Wales) ...	- ·02	+ 1·6	Moderate excess.

The rather remarkable coincidence noticeable for each of the above elements over both these widely separated regions during the three preceding months has apparently disappeared during October, excepting to some extent in the case of temperature—this element being in excess over both these countries. The other two elements, *i.e.*, pressure and general weather conditions, show entirely different values for each country.



New South Wales Timbers in South Africa.

MR. VALDER, Commercial Agent in South Africa, forwards three photographs, which are reproduced, showing the use to which New South Wales timber is being put in South Africa. From the magnitude of the operations depicted, some idea can be formed of the hold our timbers are getting in that country.

Preparing Ironbark Fenders for Dom Pedro Jetty, Port Elizabeth.
Ironbark fenders 16 ft. 6 in x 12 in. x 9 in

Blackbutt Decking.

The Dom Pedro Jetty, upon which the Blackbutt decking was used, is the finest jetty in South African waters, being 1,460 feet in length by a breadth of 105 feet at the widest part, and it cost upwards of £200,000. The framework piles, girders, bracings, &c., are all of steel, and very strongly constructed, as the jetty is exposed to the full force of the ocean.

Fenders.

In consequence of the heavy swell experienced almost continuously in Algoa Bay, it has been found that the fenders upon the jetties at Port Elizabeth are subjected to a great amount of friction from the lighters and other small craft rubbing against them. Several strong timbers have been used for fenders, but none, so far, have resisted this wear for any length of time. Mr. Valder recommended the Harbour Engineer to try Ironbark, which he eventually did, and these fenders, which are shown in the photograph as being prepared, are a portion of a large number which have now been placed on all the three Port Elizabeth jetties.

The ship "Zealandia" brought 20,000 sleepers from Newcastle, New South Wales, being an instalment of a contract for the supply of 315,000 sleepers to the Cape Government Railways.

Laying Blackbutt Decking, Dom Pedro Jetty, Port Elizabeth.
Planks 30 ft. x 9 in. x 4 in.

Unloading Sleepers from ship "Zealandia" at Cape Town Docks for the Cape Government Railways.
20,000 Blackbutt and Tallow-wood sleepers, size 7 ft. x 10 in. x 5 in.

The Butter Trade.

Mr. Valder, Commercial Agent in South Africa, reports that for several years past the various South African Governments have given special attention to encouraging the farmers to increase their output of dairy products, and it was generally considered that these efforts would result in a greatly decreased import of butter during the year 1905, compared with that of the previous year. This has not, however, been the case, as the following returns will show:—

	Weight in Pounds.	Declared Value.
1904 ...	10,631,093	£450,649
1905 ...	10,451,949	461,207

During the past year trade was generally very depressed, and I doubt if the consumption of butter was equal to that of 1904; it would seem, therefore, as if the local output had fallen off. I hardly think, however, that this can be the case, as the farmers have given greater attention to dairying of late; the number of dairy cattle has increased, and a greater amount of forage has been grown for them. The local output of butter must increase before long, if it has not already done so, but I am of opinion that the increase will be very gradual for the following reasons:—

1. Good pasture land is very limited, only existing in small patches in a few districts.
2. Very little of this land is situated in districts where the rainfall is sufficient to enable the farmers to produce butter at a reasonable price, *i.e.*, at a price at which they can compete against the imported article.
3. Consequently the development of dairying depends to a very great extent upon the development of irrigation, and this, in a country where water is anything but plentiful, is of course slow.
4. The South African farmer has not yet seriously taken up the question of laying down permanent pastures. Even on the irrigated lands he has not yet advanced beyond growing forage for the market.
5. South African cattle have been bred first for labour and secondly for beef. Little attention has been given to developing them for butter production. Consequently it will take many years to breed up large herds of dairy cattle.

The following were the imports of butter from the various countries, which came through British ports during the past three years:—

	1903. lb.	1904. lb.	1905. lb.
Argentina	3,712,054	2,642,850	3,200,783
Victoria	4,537,616	4,668,560	2,617,534
New Zealand	1,618,516	1,194,606	1,910,849
Queensland	2,800	701,222	1,294,323
New South Wales ...	1,042,102	633,443	607,446
United Kingdom ...	665,156	292,701	327,249
Holland	687,561	237,821	154,216
France	35,940	125,264	104,099
Other countries ...	649,523	134,626	225,450
Total ...	12,951,268	10,631,093	10,451,949

Australia supplies about one-half of the total quantity of butter imported, the following being the total amounts for the three years:—

1903	5,582,518 lb.
1904	6,003,225 ,,
1905	4,534,663 ,,

From this it will be seen that there was a big falling off last year in the imports from Australia. This was due to a shortage in Victorian supplies, that State sending in 2,000,000 lb. less in 1905 than in 1904. Through the greater portion of the year Victorian first grade butter was quoted at ½d. per lb. higher than Argentine first grade, with the result that there was a greatly increased Argentine trade at the expense of Victoria. Queensland again greatly increased her supplies, whilst New South Wales shows a slight decrease. New Zealand once more improved her position, and this in spite of the fact that quotations for butter from that country were always at least ½d. per lb. in advance of any other imported butter.

New Zealand butter is now regarded as the best supplied to this market. Victorian and Argentine come very close to this, New South Wales being the next in order, and then Queensland.

The demand, however, is not by any means for first grade butters alone. Cape Colony, for instance, buys a large quantity of second grade and even third grade butters, which is supplied almost entirely from Australia. Argentina apparently supplies nothing but first grade butter to this market, and partly owing to this she has established an excellent name for her butter. The Cape Town grocer often will not pay first grade price for his butter; he maintains that many of his customers are quite content to take second grade, in fact, that they do not know the difference, and that, as he gets the same price for it, he of course makes a much greater profit. In Natal and the Transvaal the demand for second and third grade butters is much smaller, most buyers taking nothing but the best quality. One reason for this is that at the Cape the climate is much cooler, and inferior butters can be handled, but in Natal and the Transvaal the climate is warm and only the good-keeping butters can be safely handled.

At Durban and Johannesburg the demand is largely for best quality Australian and New Zealand butters, with a small demand for second grade; whereas at the Cape there is a big sale for Argentine, and smaller for Australian and New Zealand first grade, together with a good sale for Australian second grade butter.

Several consignments of New South Wales butter received here were quite equal to anything placed on this market. At one cold store I inspected five different brands of butter: two of these were from Victoria, and one each from New Zealand, Argentina, and New South Wales. Of these five samples, all of which were sold as first grade, the New South Wales sample was undoubtedly the best, and the buyers stated that it was quite equal to any butter coming into this market. This consignment came from the Berry factory.

On the other hand much of the butter sent here from New South Wales, even when sold as "choicest," is not nearly equal to most of the first grade butters sold here. The great difficulty is to procure from New South Wales, and in fact from the other Australian States, a large even supply of first grade butter. Both Argentina and New Zealand seem to have a very great advantage over us in this respect. Two examples of really first-class supplies which I can quote are those of "Rincon" butter from Argentina, and "Taieri" butter from New Zealand.

"Rincon."—This butter has the largest sale of any brand. The quality can be relied upon as being of an even first grade; the supplies are large and regular; the colour is pale and just suitable in this respect for the South African market; the pats are uniform, well made, and weigh 16 oz.; and the paper wrappers are of good quality, with the brand attractively printed thereon.

"Taieri"—Quality excellent, in fact equal to any butter placed on this market; both the quality and the method of packing are slightly superior to "Rincon," and, as this butter keeps wonderfully well, it will always bring top prices. Orders for it often have to be refused.

A large proportion of the Australian butter sent here is much too dark in colour for this market. South African buyers require a very light coloured butter, and as Argentine butter is nearly always much lighter in colour than Australian it often gets the preference. If a buyer is offered two butters of anything near the same quality at about the same price, he invariably selects the lighter-coloured one, even if it is slightly inferior in quality. Our agents here inform me that they are continually bringing this fact under the notice of suppliers, but that in spite of this it is difficult to get them to send light-coloured butters.

New Zealand butter would be a much more formidable competitor were it not that butter freights are much higher from there than from other countries.

New South Wales exporters do not pay as much attention to this market as the Victorian and Queensland butter exporters. These latter are well represented at all the leading centres, whereas very few New South Wales firms have representatives in South Africa. I consider that it would pay our butter exporters to give more attention to this market. The Cape should especially be a good field for operations. With the aid of the ¼d. per lb. preference Australia should be able to easily recapture most of the trade that has gone to the Argentine, and there is no reason why New South Wales should not have a large share of this.

The duty upon butter is now 2¼d. per lb., with ¼d. per lb. rebate to the United Kingdom and reciprocating colonies.

Orchard Notes.

W. J. ALLEN.

DECEMBER.

IN districts where apricots are grown for drying and canning, some will be found ripe enough for handling this month. To make the best dried fruit, allow the apricots to hang on the tree until they are perfectly ripe—but not over-ripe, or so that they cannot be cut in halves with a sharp knife and still retain their shape. When the fruit is fairly soft, pick it carefully into cases; this will, in all probability, necessitate going over the trees five or six times. As soon as possible, have the cases carted to the cutting-shed, where the fruit should be carefully and evenly cut in halves (not pulled apart) and the stones removed. Place evenly on the trays with the cut side up, and as soon as possible remove each tray to the fumigator, where it may remain with the door closed until the fumigator is sufficiently full to start the sulphur burning. This is of the utmost importance, as when once the fruit has been cut it must not be exposed to either sun or wind.

When everything is ready, place sufficient sulphur or brimstone to fill the room with fumes for about three hours (from 1 lb. to 2½ lb., according to size of room), but, if possible, allow the fruit to remain in the sulphur-room from eight to ten or twelve hours, or until the cup is full of juice. It can then be taken out and placed, either in the sun, or in the evaporator, as the case may be, immediately. If in the evaporator, do not place the fruit in the hottest part to begin with, but gradually work from the cooler to the hotter part, say, starting at that part which is 140 degrees, and finishing off at 160 or 170 degrees Fah. In this way the fruit will dry in from fourteen to eighteen hours; but the greatest care must be taken not to allow it to burn; and some practice will be required to tell when it is just dry enough.

If the fruit is to be dried in the sun, use wooden trays 2 feet x 3 feet, which are made for the purpose, with a 2½ inch cleat at both ends. These are easily handled, and can be used in connection with all fruits.

In cutting the fruit and placing it on the trays, place it on the top part, or so that the cleats at the ends will be resting on the ground, thus allowing a current of air to pass underneath and assist in the drying process. If the weather is hot, which it usually is about Christmas time, it will take from two and a half to three and a half days to dry the fruit, which will require to be sorted over so that any which is not quite dry may be put on trays and allowed to stand for another half-day or so. The dried fruit should be taken from the trays and put immediately into clean calico bags, and securely tied so that the moths may not reach it.

When sorting over in the above manner, any fruit which is small or of bad appearance should not be mixed up with the good, but sorted out and marked as inferior, while the good also can be marked accordingly. When the fruit is dried and bagged, it should be at once stored in a cool, dry place; if exposed to heat it will become hard, lose in weight, and deteriorate in quality.

Should, by any mischance, the moths have got into the fruit and deposited their eggs therein, an effectual means of cleaning or ridding such infested fruit is to dip it into boiling hot water for a few seconds, and then spread in trays and allow to dry by exposure to the sun's rays for a few hours. Fruit thus dipped will not keep its colour long, consequently, it should be disposed of as quickly as possible.

Some beautiful cherries are already finding their way on to the Sydney market, the grading and packing of which are exceedingly nice. The cherry-growers of this State are to be commended for the creditable and up-to-date manner in which their fruit is put up; and their example could well be copied by many of our apple, peach, and citrus growers.

In the drier districts, where irrigation is practised, it will be found necessary to water all trees, vines, lucerne, or any other crops this month, and be sure to work up the ground as soon as it is dry enough to allow the horse and cultivator on the land.

All orchard land should be kept free from weeds, and to accomplish this, the horses and cultivators should have but little rest this month, as an orchard, neglected for a few days, will soon be covered with a coating of summer grass, which will take many a hard day's work to eradicate; and couch grass spreads rapidly when left undisturbed. Where there are bad patches of couch grass, these should be ploughed up and harrowed on a very hot day, as the roots soon die when exposed to the sun.

Passion-vines which have been properly pruned and manured during November will now be putting on good growth and blooming freely. This fruit will be ready to meet the demand at Easter, when it usually finds a ready sale at good prices.

Keep a strict outlook for pests, and if trees have not been fumigated or sprayed, as the case may be, the grower should lose no time before beginning to fight them.

For scales on citrus trees, December, January, and February are good months for either spraying or fumigating; but, for fungus diseases, it is generally best to spray once before the trees bloom, and again as soon as the fruit has set, rather than leaving it until now. In many cases, however, later sprayings are both beneficial and necessary. The grower should not neglect to either fumigate or spray all citrus trees, so as to ensure clean fruit and healthy trees.

Keep a strict watch over all bandages placed on apple, pear, and quince trees. They should be overhauled and all larvæ destroyed at least every ten days; also, pick up and destroy all fallen fruit.

If fruit-fly should make its appearance, all infested fruit should be destroyed, so as to assist, as far as possible, in keeping this pest in check.

In tropical districts pine-apples may be planted if moist weather prevails. Suckers are the best to plant, being much the strongest and earliest to arrive at maturity. Being great feeders, a dressing of strong nitrogenous fertiliser will promote rapid growth and fine fruit. While the plants are young, cultivation must be thorough, but not deep enough to cut the feeding roots which are near the surface.

Bananas and other tropical fruits may also be planted during the rainy season.

Thrips attacking Apple Blossom.

During the past month, Mr. Froggatt, Government Entomologist, had occasion to visit Buxton to investigate the cause of apple bloom falling off without setting. On examination, the cause was found to be due to the common rose thrips (*Thrips tabaci*), figured in the *Gazette* for October. This is the first record Mr. Froggatt has received of thrips damaging the flowers of orchard trees; but growers of fruit might be on the look-out next season, should these minute and troublesome insects put in an appearance. The ordinary sprays, such as sulphur, lime, and salt mixture, do not appear to have any effect in saving the blossom from attack, as the thrips come on when it is too late to spray with such mixtures without damaging the blossom.

Mr. Froggatt suggests a spray of tobacco and soap, to be applied when the buds are just ready to burst, and again after the petals have fallen.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

Directions for the Month of December.

Vegetables.

As was expected last month, the weather has been favourable throughout the State for the garden, and a good general rain, at time of writing, indicates that the season will continue favourable for the remainder of the year.

There are numerous places, even in some of the dryest districts of the State, where water can easily be obtained, if not in the creeks and water-courses, at a comparatively shallow depth below the surface, so that there need be no excuse for any want of the very necessary vegetables. A simple system of irrigation can be carried out by anyone without difficulty, if use be made of the old, old method which has been in operation in the East for thousands and thousands of years, and which is in use in many places in the State, and has been, probably, since the Colony has been established. All that is necessary is a bucket, oil-drum, kerosene tin, or any other vessel available, a long pole with a weight or counterpoise on one end and a support for the pole. In ancient times, and even in some parts of the East to-day, buckets of cowhide were and are used, but these are gradually giving place to kerosene tins. When visiting Pilliga scrub recently, I came across a settler who started work about 2½ years ago with practically no capital, but energy and determination, and with no knowledge or experience in farming or gardening, but who soon cleared and grubbed about a quarter of an acre of land, rigged up one of the water lifts referred to, and raised a sufficiency of vegetables for his family and also a surplus to dispose of. He now has a considerable area under fruit trees and vegetables, and raises enough vegetables to supply distant neighbours at good prices. This, of course, is only a portion of his work, and I regret that I have not sufficient space to record his interesting story as an illustration of what perseverance will effect against apparently insurmountable obstacles, and by a young man brought up to indoor occupation.

When irrigating, use as little water as possible, merely sufficient to keep the vegetables growing satisfactorily, and apply the water to the vegetables in furrows alongside the vegetables. To do the work properly the ground should be made as level as practicable; indeed, it is always advisable to make the ground level for vegetables whether it be irrigated or not. Overwatering causes excessive growth, and, consequently, the

vegetables are watery and flavourless; and when anyone takes the trouble to grow his own vegetables he may just as well grow the very best he possibly can.

Referring to Pilliga scrub reminds me that I was a good deal surprised to find how widely an excellent vegetable has become distributed, for every here and there, and quite away from ordinary traffic, I found the New Zealand spinach growing sometimes well, sometimes indifferently, according to the locality. The seeds have probably been distributed by means of sheep and cattle. Now, this vegetable is well worth cultivating, for it is as good as any of the well-known garden spinach, quite easy to grow, and a very heavy cropper. Its botanical name is *Tetregonia expansa*.

Beans, French or Kidney.—This vegetable should be bearing well in all but the cold parts of the State, and the plants should, if well looked after and all the beans are picked before they are ripe or nearly ripe, continue to produce for some time; but before the plants show signs of ceasing to bear well, plant a row or two with seed, and the fresh plants will soon take the places of the old ones, which may be pulled up and used for manure or blanching celery, or for a mulch. Scarlet runners will bear for a long time if the beans are gathered regularly and before they are large and nearly mature.

When digging and manuring ground for the beans, mix some sulphate of lime with the farmyard manure or dung if easily obtainable, or add some superphosphate of lime, not a very great deal, say 2 or 3 lb. weight, or even half that, in the dung you are likely to use to the perch. A perch measures 16½ feet x 16½ feet. It is always as well to measure the ground you are making use of for vegetables, or, indeed, for anything for that matter. When manuring for beans or for any other kind of vegetables use farmyard manure, avoiding the dung of the pig, and if artificial manures are used, apply some farmyard manure as well. If the farmyard manure is difficult to obtain, use raked-up leaves or any vegetable matter procurable.

Broccoli.—A very little seed may be sown, and when the seedlings are large enough to move from the seed-bed, prick them out in a small well-manured bed about 4 or 5 feet or so apart, and afterwards plant out in the garden. Before and after moving the young plants, water them well.

Cabbage.—This vegetable is, probably, with the exception of the potato, the chief vegetable used in Australia, and it seems to be a necessity for the general public who cannot get on without cabbage. No matter how coarse or rank it may be, cabbage must be had; and sometimes, in time of dry weather, cabbages are carried hundreds of miles. I have travelled with cabbages for more than 1,000 miles, and at the end of the journey they were not particularly choice. If I happen to inquire why cabbages and cauliflowers are not grown in certain places where soil is good and water plentiful, the excuse is that some bug, or caterpillar, or aphis, or

something or other prevents the growing of the vegetable; but, as a rule, I form the conclusion that want of energy is the true cause. Seed of cabbage may be sown, just in sufficient quantity to keep up a supply of plants for pricking out and planting out.

Cauliflower.—Sow a small quantity of seed. Sow thin, and endeavour to raise good strong plants for pricking out. A great deal depends on good treatment of seedlings for satisfactory flower heads.

Carrot.—Sow a little seed.

Cucumber.—Seed may be sown in pots or boxes, and when the seedlings have made two leaves they can be transferred to the open garden; or seed can be sown in the garden if thought best. Some liquid manure should be given to plants which are not making good headway in the garden. Rain, however, will do more good than anything else.

Celery.—Sow sufficient seed to keep up a supply of plants. Prick out seedlings from seed-bed and plant a few well-grown plants in shallow trenches. Celery is a semi-aquatic plant and needs a good deal of moisture, and in order to grow it to perfection a good deal of manure is necessary. Earth up or cover up advanced plants that are nearly full grown.

Cress and Mustard.—Sow seed occasionally to keep up a supply. The soil should be well manured, and if the weather is at all dry, frequent waterings will be necessary.

Capsicum.—This may be planted out, or seed may be sown if plants have not already been raised.

Egg-plant.—May be planted if seedlings have been raised and are large enough, or seed may be sown if plants are required. In some of the early districts the egg-plant should be fruiting by this time.

Maize, Sugar or Sweet.—May be sown as extensively as may be required. So far, this is not much used here as a vegetable. It is quite different to the ordinary maize that is grown, and vastly better for use as a vegetable.

Onion.—Anyone desiring to grow onions may try a little seed. In harvesting onions be careful not to bruise them, and dry them off in a cool shady place. Onions of the best varieties may be kept for a considerable time if they be allowed to mature properly in the ground, and are not dug before they are thoroughly ripe and the leaves and stems are quite withered up.

Peas.—If the weather is satisfactory and moist and the ground in a good condition and not over dry, a few rows may be tried during the month.

Pumpkin.—Seed may be sown if more plants are required.

Radish.—A little seed may be sown now and then through the month.

Spinach.—Sow a little seed.

Tomato.—Fruit should be ripe or ripening almost everywhere. All diseased fruits should be removed from the plants and burnt. Seed may be sown if late plants are required.

Turnip.—Sow a little seed from time to time.

Flowers.

Dahlias and chrysanthemums will need attention should the weather prove dry. The former should be well supported as they grow, or the branches are almost certain to break down with the weight of flowers. If very fine specimens of flowers are required, some thinning out of branches and also of flower buds will be necessary.

Liquid manure, occasionally supplied to both the chrysanthemum and the dahlia, will be beneficial if the plants are at all backward. Well-grown pot roses may be planted out towards the end of the month if the soil is in a good, fairly moist condition. The plants, in any case, should be well watered and afterwards mulched with stable manure.

Numbers of plants should be in flower during the month, if the weather continues to be favourable. Sunflowers of various kinds are gay and useful flowers, which soon grow and brighten up a garden. If none have been planted, seeds may be sown, and plants will soon be ready for setting out in the garden.

Answers to Correspondents.

A Queenslander.—Probably the breed of sheep most likely to succeed in your district would be the Romney Marsh or Kentish. This breed has been tried at Wollongbar Experimental Farm, Richmond River, and has been found satisfactory. With regard to Angora Goats, refer to the *Agricultural Gazette* for October, 1903, or Miscellaneous Publication No. 683, which may be obtained on application to the Director of Agriculture, Sydney. From this pamphlet, which contains considerable information about Angora Goats, you will be able to form an opinion as to whether they are likely to succeed and be profitable in your district.

Farm Notes.

Hawkesbury District—December.

H. W. POTTS.

In so far as weather was concerned, better conditions could not be wished for to get in the hay crops last month. The yield was the lowest on record. This was anticipated, from the fact that the rainfall was the lowest since 1862. The average annual rainfall during the College period of records for this district is 32 inches; the highest being 52 inches. During what is known as the big year of the drought throughout the State (1902), our rainfall was 19·15 inches. Unfortunately for us the drought has not broken. The rainfall for the first eleven months in 1905 was 16·12 inches, and for a similar period this year it is 15·6 inches. This explains the position from a produce point of view. Waterholes and other natural storage basins are dry this year, for the first time in the memory of the oldest inhabitant. It is a matter of satisfaction to know, fortunately, that these conditions exist only in very limited areas on the coast-line.

Light frosts were experienced the first week in November. These tended to check early growth, and in some instances, along the river, effected some damage to the early maize crops and young pumpkins.

The grain crops this season are very light and rusted.

The second cut of lucerne hay will be fairly heavy, owing to the timely effect of a few thunderstorms. Each year it is noted a larger area is being brought under lucerne in the district. The impression prevailed for many years that this plant needed highly nourishing soils and unlimited moisture, hence only the rich river bottoms were utilised to grow it. This idea has been successfully disputed, and the uplands are now being cultivated for lucerne. Its profitable growth on light, sandy soils has been fully demonstrated on the College Farm, and under conditions of soil and moisture generally looked on as most unfavourable. The cuts are not heavy; but the fact remains that from ½ to 1 ton per acre has been taken off 40 acres three and four times annually during the past three years.

Opportunity might be now taken to bring land into good condition for sowing lucerne at a later period. The stubbles of hay land can be turned in for this purpose, and top-dressed with gypsum at the rate of 10 cwt. per acre.

Maize.—The usual attention must be given to the young corn crops by means of shallow cultivation to destroy weeds, and fine the soil surface to create an effective earth mulch and to check evaporation. This is more urgent now, owing to the absence of moisture in the subsoils. Continuous

dry seasons have exhausted the underground supplies. Every effort should be made to fix and conserve any rainfall from thunderstorms or other sources.

Owing to the poor yield of hay, it will be necessary to make greater provision for next winter's stock fodder from summer crops in the form of maizes, millets, sorghums, cowpeas, and pumpkins. Those maizes and sorghums best suited for conserving as ensilage should have attention.

Fresh sowings of corn may be made up to the end of the month, and selected from the following varieties:—Red Hogan, Pride of the North, Golden Beauty, and Hawkesbury Champion for grain; Hickory King and Early Mastodon for ensilage. Where the soil is friable and well cultivated 1½ cwt. per acre of the following fertiliser may be used to advantage:—Two parts bone-dust to one part No. 1 superphosphate.

Sorghums.—The experience of the past five years may be safely forecasted this season. The conditions all point to similar demands. Sorghums have, in each period of scarcity, given us ample proof of their great value for the dairy herd, horses, and sheep, not only as green fodder, but also in the preserved state as ensilage. Early Amber Cane, Planters' Friend, and Sorghum Saccharatum give the best results. The land may be prepared at once and brought into fine tilth and manured as for maize. The chief aim should be to grow green fodder for stock for the end of summer right up to the middle of July.

Millets.—Sowings of these useful fodders may be continued this month. The need for green forage in February and March may thus be met

Cowpeas.—In this legume we have another fodder, green and succulent in midsummer, and affording the additional advantage of renovating the soil. The crop now occupies a permanent place in our rotation, and amply fulfils all the functions claimed for it. This season, above all others, is the one to test the value of this useful plant. Whenever soil needs stimulation and humus, the cowpea is the best crop in a dry season. The plant thrives on light, sandy soils, and under trying conditions. The question as to the possibility of stock not liking it as a green fodder cannot be raised now. That point is permanently settled. Horses, cattle, sheep, and pigs evince a marked partiality for it during the dry months. In the rotation we find it most suitable to follow cereals or hay crops. The crop may be eaten off by stock, converted into hay, or preserved as ensilage. In the latter case, we are conducting an experiment to test its value in conjunction with maize. Being of a climbing nature and highly nitrogenous in character, the test being conducted is to determine its value in enriching ensilage. The plant will grow around the stem of the maize plant and run upwards. When cut in combination, chaffed, and siloed, it ought to afford a ration much enhanced in food value. Protein should be in better proportion to the carbo-hydrates. The soil should be prepared for the crop by grubbing it into a fine condition with thorough cultivation. The peas may be planted in drills 3 feet apart with the seeds 6 to 8 inches from each other. It will require from

7 to 10 lb. of seed per acre, according to the variety. The ordinary maize-drill may be used with the plate set to the ⅜-inch hole. In all cases the addition of lime, in the form of gypsum, ½ ton to the acre, or a dressing of 1½ to 3 cwt. superphosphates is useful. The varieties best suited to our local conditions are White, Warren's Extra Early, Warren's New Hybrid, Black, Whip-poor-Will, Iron and Clay Coloured.

Sweet Potatoes.—These edible tubers are becoming more popular, yearly, as a vegetable. The main crop may now be planted out where the ground is in good order and well cultivated. Where rapid growth is desired, the addition of a heavy dressing of farm-yard manure will afford the best results. Where the soils are light and sandy, the yields, with moderate moisture, will reach from 4 to 6 tons per acre. Whilst the tuber contains a higher percentage of moisture than the ordinary potato, from a food point of view in other details they are similar. The following varieties afford profitable returns:—Jersey Red, White Maltese, Pink, Big Stem, Jersey Yellow, and Persian.

Root Crops.—The late sowings of mangolds and sugar beets may be made this month. The earlier crops will need attention by thinning out, weeding, and cultivation.

Pumpkins, Melons, Squashes, Marrows, and Grammas.—Further sowings may be made, especially of those sorts required to preserve at the end of the season for winter feed. The existing plants will be better for cultivation and mulching.

Glen Innes District—December.

R. H. GENNYS.

Potatoes.—For the main crop, which is intended to be kept over the winter, the early part of this month is suitable for sowing, and so far, the old favourite variety Brownell's Beauty has proved the best all-round potato. Some other sorts on this farm are, however, showing up well, Satisfaction and Irish Flounder being two of the best, while Early Northern, on a small scale, has done very well. Aroostook, County Prize, and Burbank's have also shown up well in their first trials on this farm. I might add to last month's Notes that it is not advisable to plant very small tubers, even if whole—say anything under 1½ oz. in weight—unless it is absolutely certain that they have been taken from under roots that have borne the majority of their tubers of large size. Buying small tubers in the open market may lead to a much deteriorated variety being planted. See that the colours of the flowers on the potato tops are true to the variety supposed to be planted. Tops that should have dark-coloured

flowers, if found turning towards white, is a sign a potato is deteriorating; do not plant from the tubers of the latter. Discard all ill-shaped, deep-eyed, nobby, coarse tubers; excrescences of all kinds must be avoided. The after cultivation of potatoes should be shallow.

Sorghums and Millets.—Sorghums may be sown for green fodder, Amber Cane and Planters' Friend being two of the best varieties. If drilled in, about 9 lb. of seed per acre would be sufficient, and about 16 lb. per acre if broadcast. If sorghum is intended to be fed directly it is cut, it should be sown broadcast, as, if not, a great portion of the stalk will be rank and left uneaten.

Millets.—These may be sown freely this month, as in under two months they will be fit to feed either as green fodder or for hay purposes. Hungarian millet makes splendid hay; it should be cut just after coming into head. New Siberian millet also makes good hay, and, if seed is required, it is a very heavy cropper. Japanese and White French are also two very good hay sorts. Millet seed should not be fed too freely to horses, as it is apt to act injuriously.

In no case allow cattle to eat the young growth of sorghums; many have died from this cause. When once it comes into head it may be fed freely.

Pumpkins may be sown to the middle of the month.

Haymaking will be in full swing this month. It is advisable to cut wheat for hay when it is coming into bloom. No grain should be allowed to form. At this stage the plant has taken up all the nutritious substances that it requires, and there is no object in concentrating the whole, or even part, of these in grain, which is indigestible, as the grain of wheat, when fed in its raw state, is admitted to be. The hay, too, is much sweeter, and the colour, which is an important point, much better.

For making hay from oats, however, it is better to let the grain form somewhat, and when the tops begin to turn white to cut. Some oats, notably Tartarian, make very bitter hay if cut too green, and in any case they ripen more than others from the top, the lower portion keeping quite green. The oats grain, unlike wheat grain, is a digestible food for horses, and most suitable in every respect.

When harvesting, as is now the custom, with reaper and binder, plenty of time in the field must be given. Sometimes it is advisable to turn the sheaves inside out, but generally this should be avoided, as it is apt to interfere with the colour; but when heating, or after heavy rains, it is often very beneficial.

Crown Lands of New South Wales

The following areas will be available for selection on and after the dates mentioned :—

For Conditional Purchase Lease—(Available under Section 10 of Act of 1905. Regulations 356 to 365. Applications to be made on Form No. 114).

C.P.L. No.	Name of Land District	Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
			a. r. p.		a. r. p.		£ s. d.	1906.
42	Coonamble..	Berida .	.. ..	1	3,193 0 0	Gilgandra railway station, 18½ miles	99 15 2	6 Dec.

Level country ; alluvial, red sandy soil in timber, black soil on plains, clay subsoil ; about 1,000 acres plain country, with scattered myall, budtha, and dead wood, balance thick forest of box, pine, oak, budtha, belar, wilga, and yarran, with budtha and wilga scrub. Water supply : Marthaguy Creek (not permanent). Facilities exist for storage by tanks or dams.

40	Narrandera	Boree Creek.	....	1	1,276 0 0	Narrandera, about 18 miles.	39 17 6	6 Dec.

Undulating ; rich deep red soil, with little gravel near north-western boundary ; timbered with old ringbarked box, box suckers, pine, and pine scrub, almost the whole area suitable for wheat growing. Water : no permanent supply, catchment good for tanks.

								1907.
	Wagga Wagga.	Mimosa .	1,258 0 0	2	640 0 0 and 618 0 0	Temora railway station and town, 16½ and 15 miles respectively.	26 0 0 and 23 3 6 respectively.	3 Jan.

The 640-acre block consists of open low loamy ridges, gravelly in places ; free-working red clayey loam of good quality ; good red clay subsoil ; timbered with green and ringbarked box ; the whole area practically suitable for agriculture. There is a tank on this block. Rainfall, about 20 inches per annum.

The 618-acre block is described as slightly undulating and flat country, part low gravelly spurs ; free-working reddish soil of fair to good quality, intermixed with quartz and slate ; good clay subsoil ; timbered with box and pine ; the whole area practically suitable for agriculture ; no natural water supply, but good sites for tanks exist. Rainfall, about 20 inches per annum.

For Original Settlement Lease only—(Available under Section 25 of Act of 1895. Regulations 148 to 157d. Applications to be made on Form No. 50).

S.L. No.	Name of Land District.	Holding, &c.	Total Area.	No. of Farms.	Area of Farms.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
			acres.		acres.		£ s. d.	1907.
844	Condobolin	Bygaloree .	7,200	2	3,800 and 3,400	Condobolin town and railway station, distant about 40 and 37 miles respectively.	47 10 0 and 42 10 0 respectively.	17 Jan.

The 3,800 acre farm consists of almost level country, with about 250 acres of ridges at the south-west corner ; good red, friable sandy soil ; timber—box and pine, the greater part of which has been killed by ringbarking. No natural water supply ; a tank of about 3,060 cubic yards capacity exists on the land. Facilities exist for water conservation.

The 3,400-acre farm is described as almost level country except for gilgai holes on about 400 acres of the north-eastern part ; good red loamy soil mixed with a little quartz and ironstone gravel, clayey subsoil ; the timber is dead excepting a little wilga, warrior-bush, box, and rosewood. No natural water supply ; facilities exist for conservation.

845	Condobolin	....	11,399	2	5,487 and 5,912	Ungarie, distant about 8 miles ; Condobolin and Wyalong, about 37 miles.	28 11 8 and 30 15 10 respectively.	17 Jan.

About 750 acres low ridges of slate and sandstone formation, the balance level or slightly undulating country ; red loamy soil, chiefly light and sandy, with clay subsoil. Timber—box, pine, oak, and yarran. No natural water supply ; facilities exist for storage in tanks or dams.

FOR ORIGINAL HOMESTEAD SELECTION ONLY—(Available under Section 14 of Act of 1895. Regulations 49 to 58A. Applications to be made on Form No. 7).

H.S. No.	Name of Land District	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date Available.
			a. r. p.		£ s. d.	1906.
1,003	Metropolitan .	2	24 0 50 and 26 3 20	About 5¼ miles from Hurstville Railway Station, on the South Coast Railway Line.	0 9 2 and 0 6 10 respectively.	20 Dec.

This is rather broken country, on the summit of a range between the Woronora River and Barden's and Still Creeks; sandstone formation, sandy soil, gravelly in places, timbered with gum, bloodwood, honeysuckle, interspersed with scrub; no permanent water, but facilities exist for conservation in gully.

FOR ORIGINAL CONDITIONAL PURCHASE ONLY—(Classified under Subsection 1 (A), Section 4, of Crown Lands Amendment Act, 1905; available under Section 26 of Act of 1884. Regulations 74 to 130. Application and declaration to be made on Forms Nos. 21 and 22).

Name of Land District.	Name of Holding, &c.	Parish.	County.	Total Area.	Price per Acre.	Date available.
				a. r. p.	£ s. d.	1906.
Gosford	....	Kooree .. .	Northumberland.	40 0 0	0 10 0	13 Dec.
Being portion 1. Suitable for grazing.						
						1907.
Eden*	Within Pambula population area.	Panbula	Auckland .	546 0 0	1 10 0 and 2 0 0	24 Jan.
Being portions 198 to 201 and 204 to 210. Residential areas, suitable for grazing, cultivation, &c.						
						1906.
Parkes*	Within Parkes population area.	Currajong	Ashburnham	74 1 32	7 0 0 to 14 0 0	27 Dec.
Being portions 653, 679 to 682, 685 to 688, 689 to 696, 702, 716 to 718. Residential areas. Suitable for grazing, &c.						
Windsor ..	....	Nelson .. .	Cumberland	60 0 0	0 10 0	20 Dec.
Suitable for orchards or poultry farms.						
Windsor ..	....	Nelson	Cumberland	40 0 0	0 10 0	20 Dec.
Suitable for orchards or poultry farms.						
Windsor ..	....	Merroo	Cook.. ..	40 0 0	0 10 0	20 Dec.
Suitable for orchards or poultry farms.						
Windsor ..	....	Merroo	Cook.. ..	80 0 0	0 10 0	20 Dec.
Suitable for orchards or poultry farms.						
Young*	Within Young population area.	Young	Monteagle ..	28 2 23	4 10 0	6 Dec.
Being portions 1,602 and 1,603. Suitable for grazing, agriculture, &c.						

* Identical with special area, see page 1266

For Original Conditional Purchase and Conditional Lease in virtue thereof.—(Classified under Subsection 1 (b), Section 4, of Crown Lands Amendment Act, 1905.) Available under Sections 26 and 48 of Act of 1884. Regulations 74 to 130. Application and declaration for Original Conditional Purchase to be made on Forms 21 and 22, and for Conditional Lease on Forms 95 and 96.

Name of Land District.	Name of Holding, &c.	Parish.	County.	Total Area.			Price per Acre.			Date available.
				a.	r.	p.	£	s.	d.	1906.
Armidale ..	Rockvale Holding (partly).	Chandler	Clarke ..	225	0	0	1	0	0	27 Dec.
		Suitable for grazing.								
Bathurst ..	....	Bringellet	Bathurst ..	625	0	0	0	8	4	20 Dec.
		Suitable for grazing.								
Bathurst ..	....	Bringellet	Bathurst ..	915	0	0	0	13	4	20 Dec.
		Suitable for grazing.								
Carcoar	....	Glengary	Georgiana .	800	0	0	0	10	0	20 Dec.
		Suitable for grazing.								
Carcoar	....	Glengary .. .	Georgiana ..	100	0	0	0	13	4	29 Dec.
		Suitable for grazing.								
Carcoar	....	Bracebridge ..	Bathurst ..	1,29[illegible]	0	0	0	18	4	1907. 17 Jan.
		Suitable for grazing.								
Carcoar	....	Kangaloolah and Wangalo.	Georgiana .	3,730	0	0	0	10	0	3 Jan.
		Grazing land.								
Carcoar	....	Kangaloolah and Wangalo.	Georgiana .	1,100	0	0	0	13	4	3 Jan.
		Grazing land.								
Coonamble ..	....	Quonmoona ..	Leichhardt ..	1,747	2	0	1	12	6	1906. 6 Dec.
		Good grazing land.								
Cowra	....	Warrumba .. .	Forbes ..	150	0	0	0	6	4	13 Dec.
		Being portion 46. Suitable for grazing.								
Dubbo	Cobra Holding ..	Adelyne ..	Lincoln	1,042	0	0	0	10	0	1907. 10 Jan.
		Being portions 46 and 48. Suitable for grazing.								
Dubbo	Narran Holding .	Narran	Lincoln ..	187	0	0	0	10	0	1906. 13 Dec.
		Suitable for grazing.								
Dubbo	Minore Holding . .	Minore and Dungary	Narromine .	4,580	0	0	0	7	6	13 Dec.
		Suitable for grazing.								
Dubbo	Ford's Creek Holding.	Yarrow	Lincoln .	3,198	0	0	0	10	0	13 Dec.
		Suitable for grazing.								
Glen Innes ..	....	Towagal . ..	Clarke ..	389	2	0	0	18	4	20 Dec.
		Being portions 26 and 27. Suitable for grazing.								
Gundagai ..	....	Bungongo . ..	Buccleuch ..	1,370	0	0	0	10	0	1907. 3 Jan.
		Grazing land.								
Molong	....	The Gap . ..	Gordon ..	200	0	0	0	13	4	1906. 20 Dec.
		Suitable for grazing.								
Mudgee	....	Wilpinjong . ..	Phillip ..	120	0	0	0	10	0	20 Dec.
		Suitable for grazing.								
Mudgee	....	Wilpinjong.. ..	Phillip ..	40	0	0	0	16	8	20 Dec.
		Suitable for grazing.								
Picton	....	Cumbertine .	Camden ..	820	0	0	0	10	0	20 Dec.
		Suitable for grazing.								
Picton	....	Cumbertine ..	Camden ..	27,040	0	0	0	10	0	20 Dec.
		Suitable for grazing.								
Rylstone ..	....	Rylstone	Roxburgh ..	420	0	0	0	13	4	1907. 24 Jan.
		Suitable for grazing.								
Scone	....	Webimble	Brisbane ..	200	0	0	1	13	4	10 Jan.
		On Wybong Creek. Suitable for mixed farming and dairying.								

For Original Conditional Purchase and Conditional Lease in virtue thereof—*continued.*

Name of Land District.	Name of Holding, &c.	Parish.	County.	Total Area.	Price per Acre.	Date available.
				a. r. p.	£ s. d.	
Singleton ..	....	Burton	Northumberland.	14,000 0 0	0 15 0	1906. 13 Dec.
		Suitable for grazing.				
Wellington ..	....	Curra	Gordon ..	1,590 0 0	0 15 0	1907. 24 Jan.
		Suitable for grazing.				
Wellington ..	....	Curra	Gordon ..	580 0 0	1 0 0	24 Jan.
		Suitable for grazing.				
Windsor ..	....	Meehan	Cook.. ..	10,900 0 0	0 10 0	1906. 20 Dec.
		Suitable for grazing.				
Windsor ..	....	Cornelia, Frederick, and Maroota.	Cumberland..	34,110 0 0	0 10 0	20 Dec.
		Suitable for grazing.				
Wyalong ..	....	Hiawatha	Gipps ..	3,134 0 0	0 5 0	1907. 17 Jan.
		Suitable for grazing.				
Wyalong ..	....	Hiawatha	Gipps ..	1,176 0 0	0 15 0	17 Jan.
		Suitable for grazing.				
Wyalong ..	....	Hiawatha	Gipps ..	1,340 0 0	0 16 8	17 Jan.
		Suitable for grazing.				
Wyalong ..	....	Bibbijolce	Gipps ..	1,050 0 0	0 18 4	1906. 13 Dec.
		Suitable for grazing.				

Conditional Purchase (Original or Additional) or Conditional Lease.—(Available by revocation of reserves, and not classified or specially set apart under Section 4 of the Crown Lands Amendment Act of 1905.) Available under Sections 26, 42, and 48 of Act of 1884. Regulations 74 to 130. Application and declaration for Original Conditional Purchase to be made on Forms 21 and 22, and for Additional Conditional Purchase or Conditional Lease on Forms 95 and 96.

Name of Land District.	Name of Holding, &c.	Parish.	County.	Total Area.	Price per Acre.	Date available.
				a. r. p.	£ s. d.	
Bombala ..	....	Maharatta	Wellesley ..	260 0 0	1 0 0	1907. 24 Jan.
On Warburton Creek. Will become available in conjunction with vacant lands adjoining.						
Braidwood ..	....	Barnett ..	Murray ..	40 0 0	1 0 0	10 Jan.
		Formerly Water Reserve 46.				
Nowra	....	Buangla	St. Vincent..	660 0 0	1 0 0	1906. 27 Dec.
		At Grassy Gully.				
Queanbeyan ..	....	Greenfield and Yarara.	Cowley ..	640 0 0	1 0 0	1907. 24 Jan.
Will become available in conjunction with vacant lands adjoining.						

Conditional Purchase as Special Area.

Eden Land District, within Pambula Population Area, 546 acres, being portions 198 to 201 and 204 to 210, parish of Pambula, county of Auckland; maximum area 92 acres, minimum area 29½ acres; residential areas, suitable for grazing, cultivation, &c.; price, £1 10s. and £2 per acre. Available for original applications on 24th January, 1907.

Parkes Land District, within Parkes Population Area, 74 acres 1 rood 32 perches, being portions 653, 679 to 682, 685 to 696, 702, 706 to 718, parish of Currajong, county of Ashburnham, maximum area 9 acres, minimum area 1 acre 0 roods 4 perches; residential areas, suitable for grazing, &c.; price, £7 to £14 per acre. Available for original applications only on 27th December, 1906.

Young Land District, within Young Population Area, 28 acres 2 roods 28 perches, being portions 1,602 and 1,603, parish of Young, county of Monteagle; maximum and minimum areas, 28 acres 2 roods 28 perches; suitable for grazing, agriculture, &c.; price, £4 10s. per acre. Available for original applications only on 6th December, 1906.